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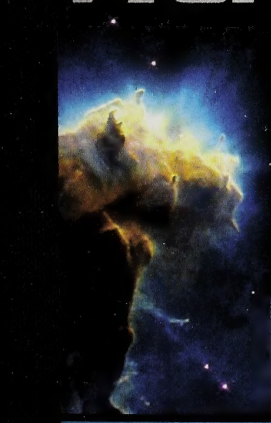
Module 2

Mathematics 6




Number Operations

Learning Technologies Branch

Alberta LEARNING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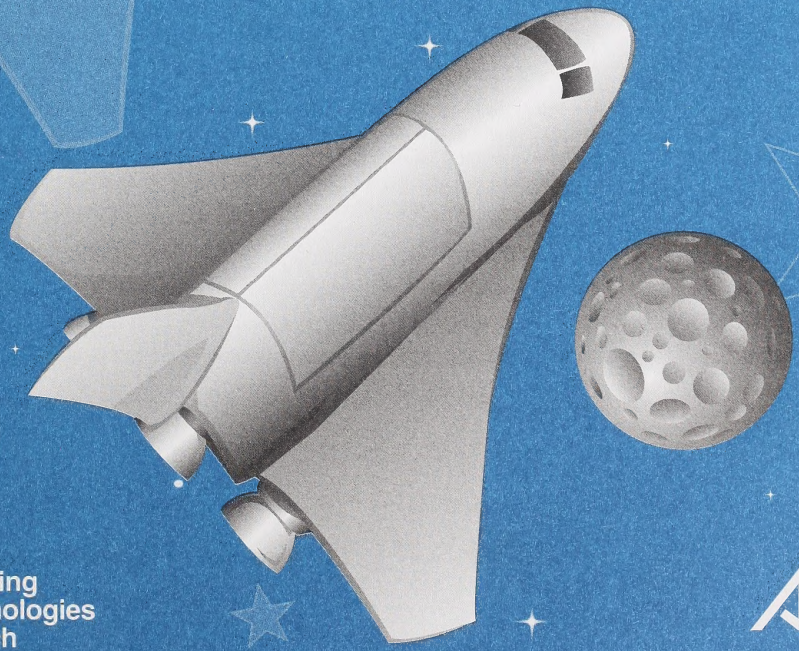
Mathematics 6

Module 2

Number Operations



Learning Technologies Branch

Alberta LEARNING

Mathematics 6
Module 2: Number Operations
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-2200-5

The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Student Module Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

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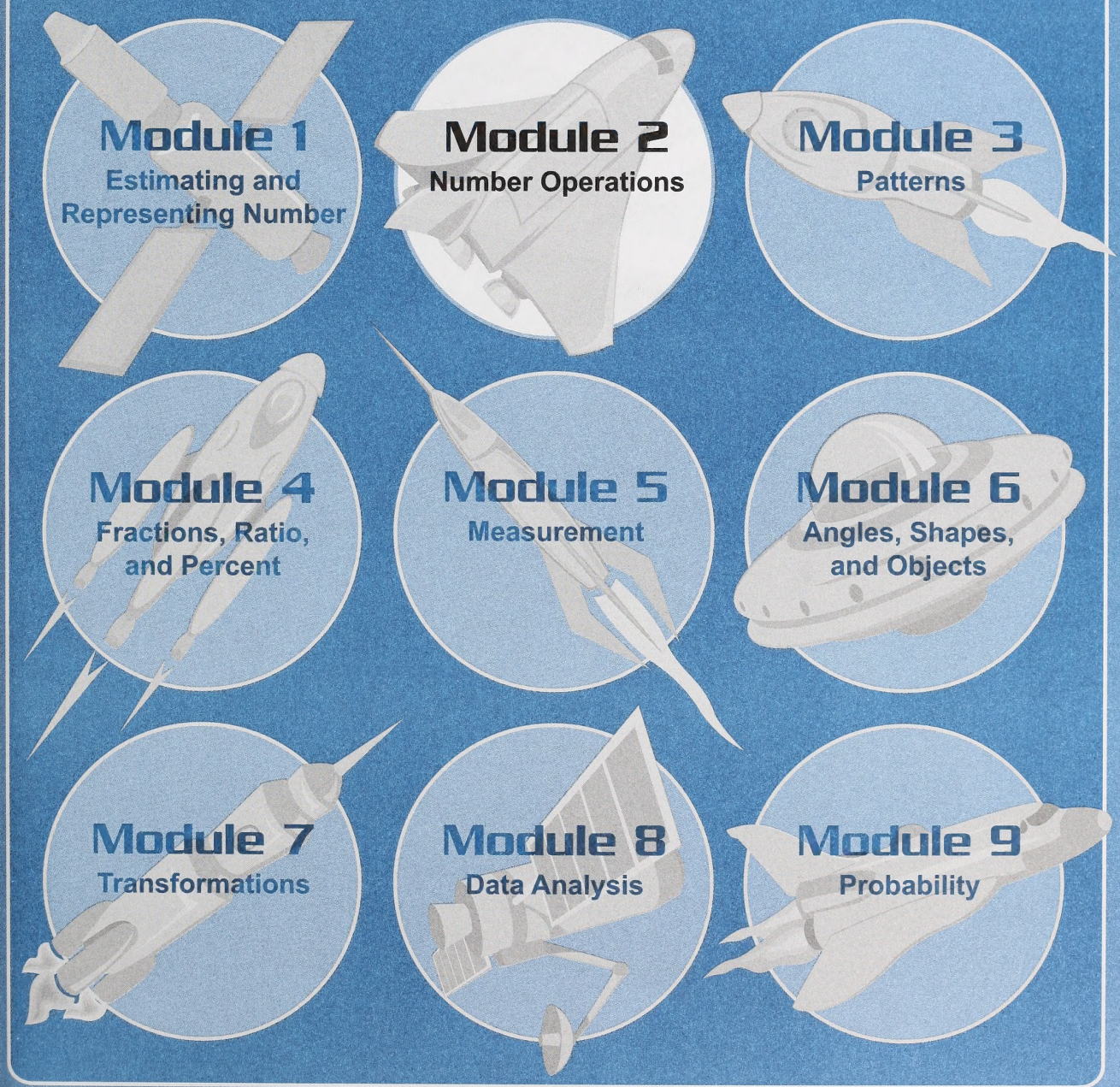
Welcome to Mathematics 6

Mathematics 6 contains nine modules.
You should work through the modules in order (from 1 to 9) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.



Module 1
Estimating and Representing Number

Module 2
Number Operations

Module 3
Patterns

Module 4
Fractions, Ratio, and Percent

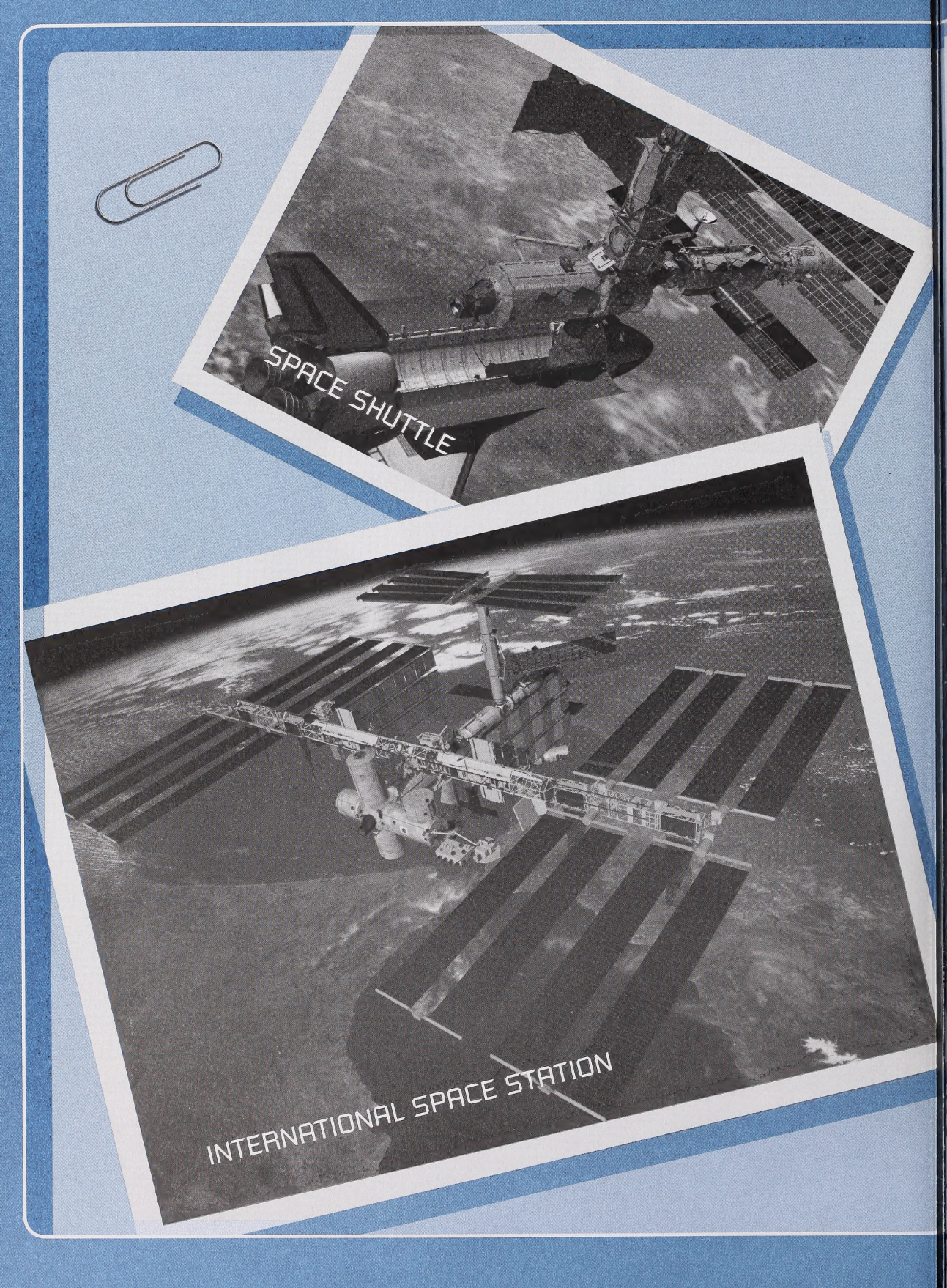
Module 5
Measurement

Module 6
Angles, Shapes, and Objects

Module 7
Transformations

Module 8
Data Analysis

Module 9
Probability


SPACE SHUTTLE
INTERNATIONAL SPACE STATION

Adventures in Outer Space

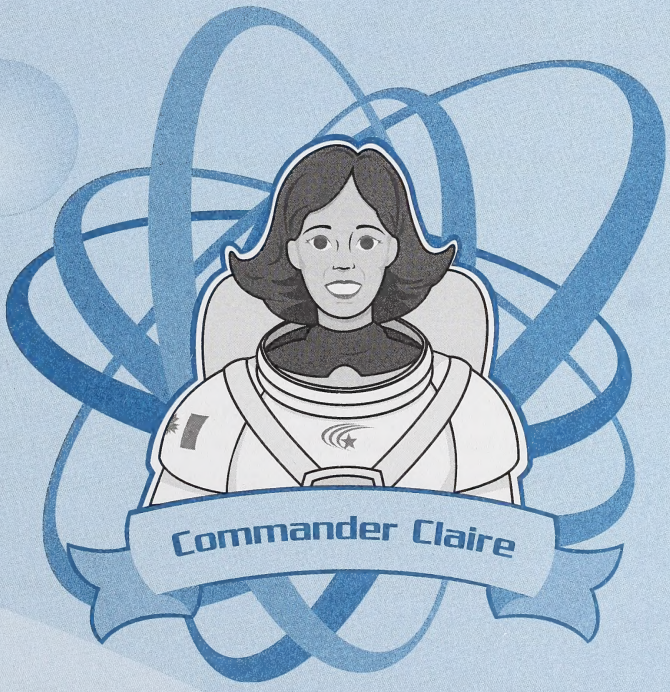
Matthew: Wow, what a wonderful experience it was meeting Colonel Chris Hadfield at the Odyssium! He gave a presentation here in Edmonton on July 9, 2001, and talked about his adventures in space, including his mission aboard the Space Shuttle *Endeavor* to attach Canadarm2 to the International Space Station.

It's too bad you missed it, Kylee. You were away visiting your grandmother in Slave Lake.

Kylee: My trip was great, but I sure wish I could have heard Colonel Hadfield talk about being the first Canadian to walk in space. But I've got great news for you, Matthew! Commander Claire from the International Space Station is coming to town, and you and I will be spending some time with her.

I can't wait to hear about her adventures in space!

Table of Contents



Course Features

Take the time to look through the Student Module Booklets and the Assignment Booklets and notice the following design features:

- Each module has a Module Overview, Module Summary, and Review.
- Each module has several lessons. Each lesson focuses on a big idea that is central to the topic being learned in the module.
- Each lesson has several activities. An activity in each lesson is related to the Adventures in Outer Space theme.
- Each module has a Glossary and an Answer Key in the Appendix. In several modules, there are also special pull-out pages in the Appendix.
- Each module has special exercises that focus on certain mathematical skills. The Numbers in the News project involves a scavenger hunt for samples of math in everyday life. The Keystrokes exercise introduces some "funky features" of the calculator that can be used to explore and practise important number ideas. Just the Facts gives you the opportunity to practise your basic number facts by doing a timed drill with your home instructor. The Mental Math exercise introduces an estimation skill or mental-computation strategy that you can use to sharpen your mental math skills.
- Each module references the Mathematics 6 Companion CD that includes additional material for review and mastery.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 6 textbook, *Quest 2000: Exploring Mathematics, Grade 6*, the soft-cover book *Quest 2000: Exploring Mathematics: Practice and Homework Book, Grade 6*, a basic four-operation calculator (such as the TI-108 calculator), and various manipulatives (base ten blocks and pattern blocks).

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

You will also need access to a computer to view material on the Mathematics 6 Companion CD.

Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.

Use your calculator.

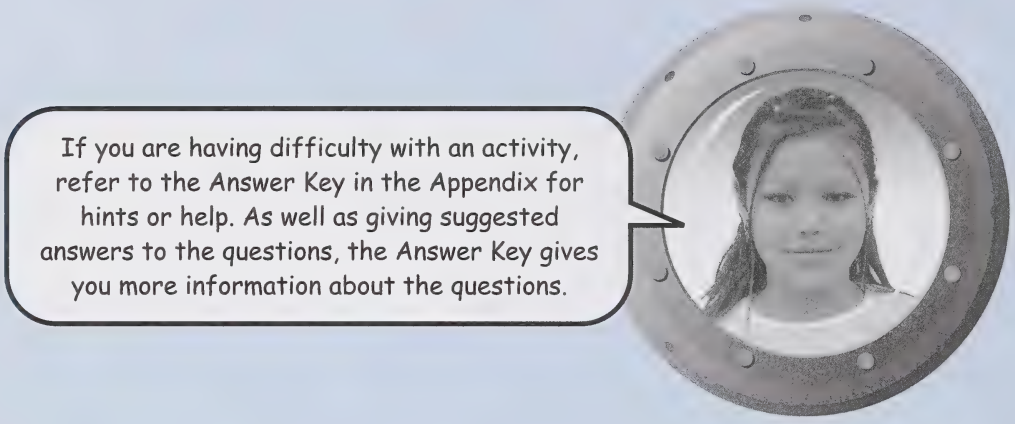
Use the Internet.

Refer to the textbook or the Practice and Homework Book.

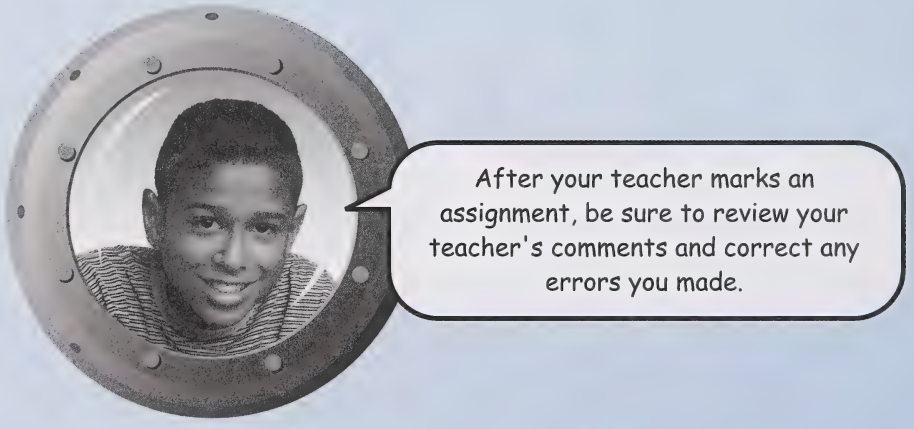
Use the Mathematics 6 Companion CD.

Assessment and Feedback

The Mathematics 6 course is carefully designed to give you many opportunities to discover how well you are doing. In every activity you will be asked to turn to the Appendix to check your answers. Completing the activities and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.

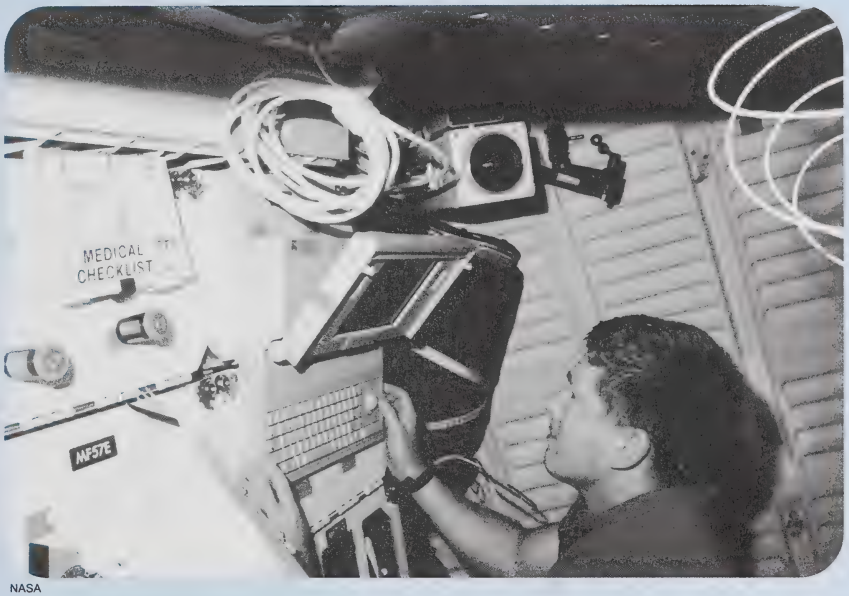


Twice in each module you will be asked to give your teacher your completed assignments to mark. Your teacher will give you feedback on how you are doing.



There will be a final test at the end of the course. You can prepare for the final test by completing the Review at the end of each module.

Module Overview



NASA

In the photograph, astronaut William Shepherd uses a computer on the middeck of the Space Shuttle *Discovery*. Space travel would not be possible without computers. Computers on the spacecraft and at mission control perform countless calculations to ensure the safety of the crew and the success of the mission.

You must also be able to perform basic calculations to be successful in school and in your career. In this module you will review the basic operations and extend your computational skills. You will use a variety of estimation and mental-computation strategies, paper-and-pencil methods, and your calculator to solve problems!

Lesson 1
Computing with Whole Numbers

Lesson 2
Adding and Subtracting Decimals

Lesson 3
Multiplying and Dividing Decimals

Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 2A

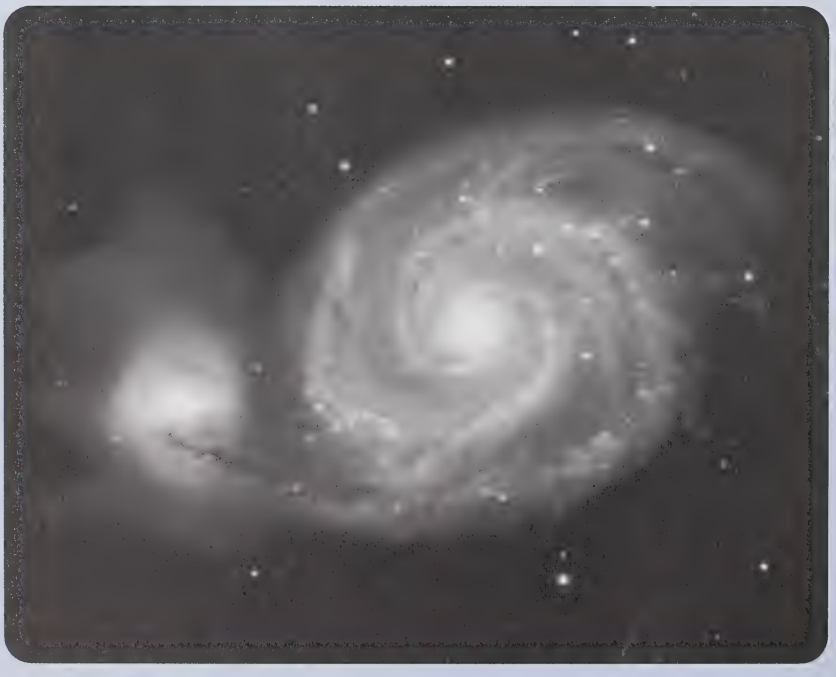
Lesson 1 Assignment	30 marks
Lesson 2 Assignment	30 marks

Assignment Booklet 2B

Lesson 3 Assignment	30 marks
Numbers in the News	10 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 2A to your teacher before you begin Lesson 3. You will submit Assignment Booklet 2B to your teacher at the end of this module.



Numbers in the News

Read through the following list before you begin Module 2. Begin by collecting samples of the ideas you already understand; others you may collect as you learn about them in the module. The samples you collect will depend on the newspapers or magazines you use.

Scavenger Hunt

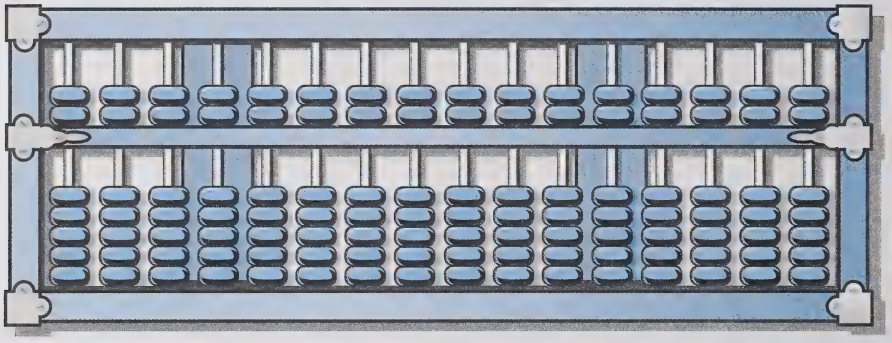
Cut out articles or advertisements from newspapers or magazines that show operations with large numbers and decimals. Here are some suggestions of things to look for:

- large numbers (especially those greater than 1 million) being added, subtracted, multiplied, or divided
- addition and subtraction of numbers that have decimals, especially those with thousandths
- decimals being multiplied and/or divided by a whole number
- estimates being made using whole numbers or decimals

You will find further instructions for completing and submitting your project in Assignment Booklet 2B.

Lesson 1

Computing with Whole Numbers



Before calculators and computers were invented, people performed basic operations using pencil-and-paper methods and the abacus. The abacus was used extensively for business in Asia. Through years of practice, shopkeepers became so proficient on the abacus that they could match the speed of a calculator or computer!

If you have access to the Internet, you can learn about the history and use of the abacus at the following website:

http://www.ee.ryerson.ca:8080/~elf/abacus

In this lesson you will practise and extend your computational skills with whole numbers. You will use a variety of estimation, pencil-and-paper, and computation strategies to solve problems.

Activity 1

Today you will practise your skills with mental math and estimation.

AP/Wide World Photos/Mikhail Metzel

What a deal!

Dennis Tito paid Russia $20 million to take him on a vacation that was literally out of this world!

On April 28, 2001, an American businessman named Dennis Tito made history by becoming the first paying passenger on a space mission. The Soyuz rocket carrying Dennis Tito and two Russian cosmonauts lifted off flawlessly from Russia's Baikonur cosmodrome at 03:37 EST on Saturday, April 28, 2001. After spending time on the International Space Station, they returned to Earth on Sunday, May 6, 2001, at 01:35 EST.

Note: EST is the abbreviation for Eastern Standard Time.

1. **a.** Estimate how many days Tito's trip lasted.

   b. Use mental computation to find the length of Tito's trip to the nearest minute.

c. Round your answer to the nearest hour.

d. Round your answer to the nearest day.

2. The first manned flight into space, which lasted 60 min, was made in 1961 by Russian cosmonaut Yuri Gargarin. Use mental computation to find out how many years after Yuri Gargarin's historic flight Dennis Tito made his.

3. Using your answer from question 1.d., mentally compute how much it cost Dennis Tito for each day of his round trip to the International Space Station.

Check your answers on pages 94 and 95 in the Appendix.

4. At the time of his trip, Dennis Tito's investment firm managed more than $10 billion in assets. Use mental computation to find how many space trips Dennis Tito could have paid for with this amount.

5. Dennis Tito was 60 years old when he took his trip into space. Imagine that you begin saving money from now until you are 60 years old to pay $20 million for such a trip. Estimate the answer for each of the following questions, and then use a calculator to verify your estimate.

a. How much money would you have to save every year?
b. How much money would you have to save every month?

6. Dennis Tito would have to pay $20 million per trip for 25 trips in order to pay the same amount that a single space shuttle mission costs the United States. Use mental computation to find the cost of a single space shuttle mission.

Check your answers on page 95 in the Appendix.

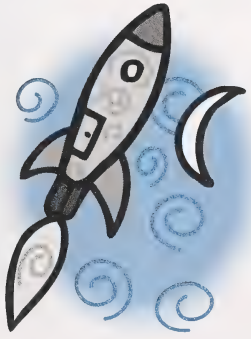
The following table gives information about the first manned space missions in NASA's Mercury Program. Use this data to answer questions 7 to 11.

Date	Astronaut	Length of Time	Distance Travelled (km)	Velocity (km/h)
May 5, 1961	Alan Shepard	15 min 28 s	488	8266
July 21, 1961	Gus Grissom	15 min 37 s	486	8266
February 20, 1962	John Glenn	4 h 55 min 23 s	121 843	28 246
May 24, 1962	Scott Carpenter	4 h 56 min 05 s	122 394	28 254
October 3, 1962	Walter Schirra	9 h 13 min 11 s	231 813	28 268
May 15–16, 1963	Gordon Cooper	1 d 10 h 19 min 49 s	879 329	28 251

7. Use mental computation to find which two flights differed by less than 1 min in length.

8. Estimate and then calculate the total length of time for all missions that took place during the following periods of time.

   a. in 1961
   b. in 1962
   c. in the month of May
   d. in the entire Mercury program



Questions 9 to 11 are optional. Complete these questions if you need more practice with mental math and estimation.

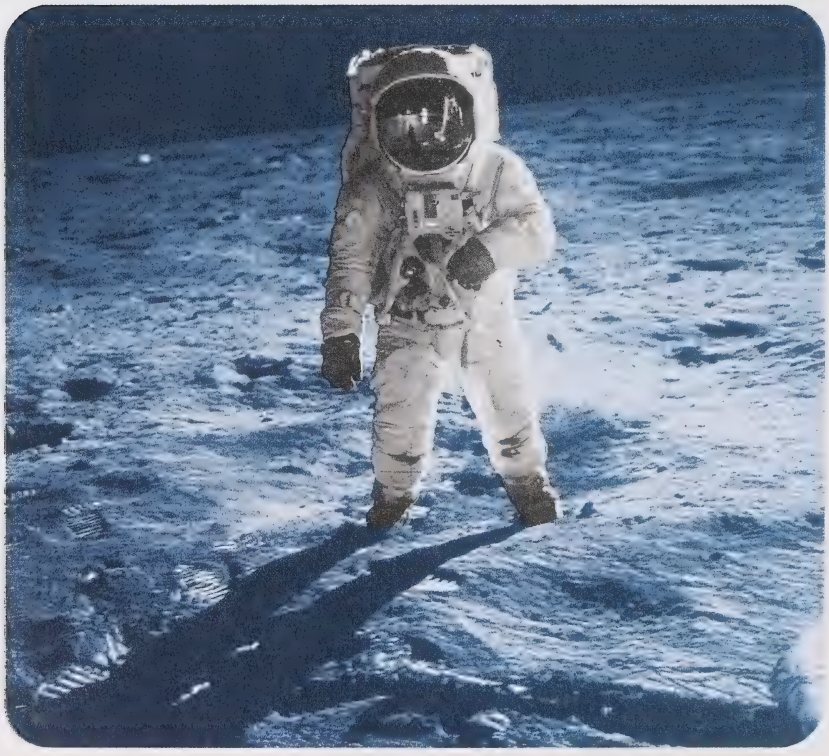
9. Estimate and then calculate the total distance travelled in all missions that took place in the following years.

a. 1961 **b.** 1962

10. Estimate and then calculate the difference between the distance that Gordon Cooper travelled and the sum of the distances for all other missions in the Mercury program.

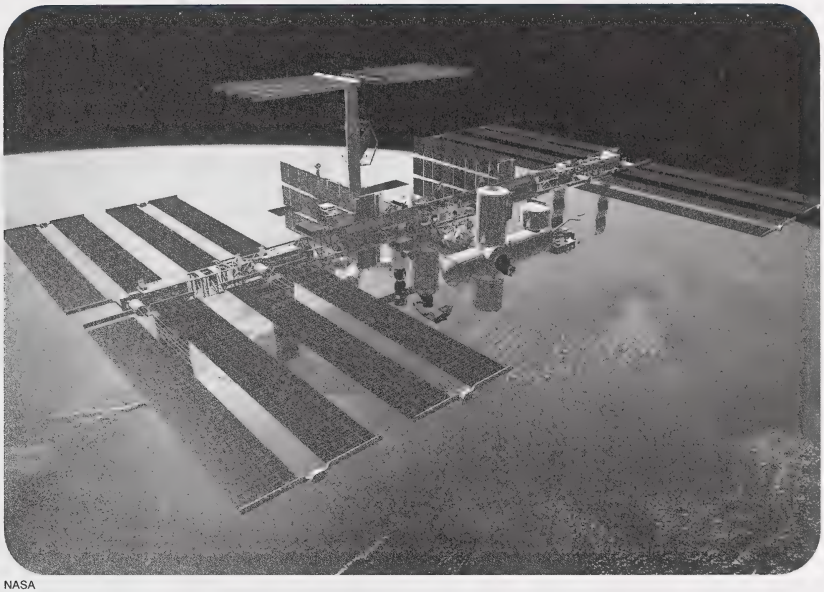
11. Use mental computation to find the difference between the velocity of Gordon Cooper's mission and the velocity of each of the 1962 missions.

Check your answers on pages 95 to 98 in the Appendix.



Activity 2

Today you will estimate answers and then use a calculator to verify your estimates.



NASA

The International Space Station (ISS) is a very bold scientific project shared by 16 countries, including Canada. When completed, it will be the largest and most complex structure that has ever been placed in orbit.

Although the ISS is designed to last a minimum of ten years, it could function for as long as 25 years. The total cost of this space station is projected to range from $60 billion to $100 billion. Use this information to answer questions 1 and 2.

1. Use mental computation to find the following costs of the project.

   a. the greatest predicted yearly cost
   b. the least predicted yearly cost

2. If each of the participating nations shared the cost equally, estimate the range of the total projected cost each country would pay. Use your calculator to verify your estimate.

3. The International Space Station is located about 400 km above Earth. The average (**mean**) distance between Earth and the moon is about 384 000 km.

   a. Estimate how many times farther from Earth the moon is than the ISS.

   b. Use your calculator to verify your estimate for question 3.a. Round your calculator answer to the nearest whole number.

   c. The distance between Earth and the ISS is what fraction of the distance between Earth and the moon? Use your answer from question 3.a. to estimate.

Check your answers on pages 98 and 99 in the Appendix.

4. The moon orbits Earth at a speed of about 3680 km/h and travels about 2 400 000 km in one complete orbit. The International Space Station orbits Earth at a speed of about 27 650 km/h, and it makes one complete orbit in 90 min. Use this information to answer the following questions. For each question, first estimate the answer and then use your calculator to verify your estimate.

   a. Compare the orbital speeds of the moon and the ISS. Which is faster, and by how many times?

   b. What is the total distance the ISS travels in one complete orbit around Earth?

   c. Compare the distance travelled by the moon and the distance travelled by the ISS as they make one complete orbit around Earth. (**Hint:** Round your calculator answer from question 4.b. to the nearest 10 000 km.)

Canadarm, the robotic arm on the shuttle *Endeavor*, is used to lift payloads and to assemble the International Space Station. Canadarm is almost 4 m long and can move about 600 kg. A larger arm, Canadarm2, which is attached to the International Space Station, is almost 18 m long and can move about 100 t.

5. Use mental computation or paper and pencil to find how many times longer Canadarm2 is than the smaller arm.

6. When completed, the ISS will have a mass of about 410 000 kg.

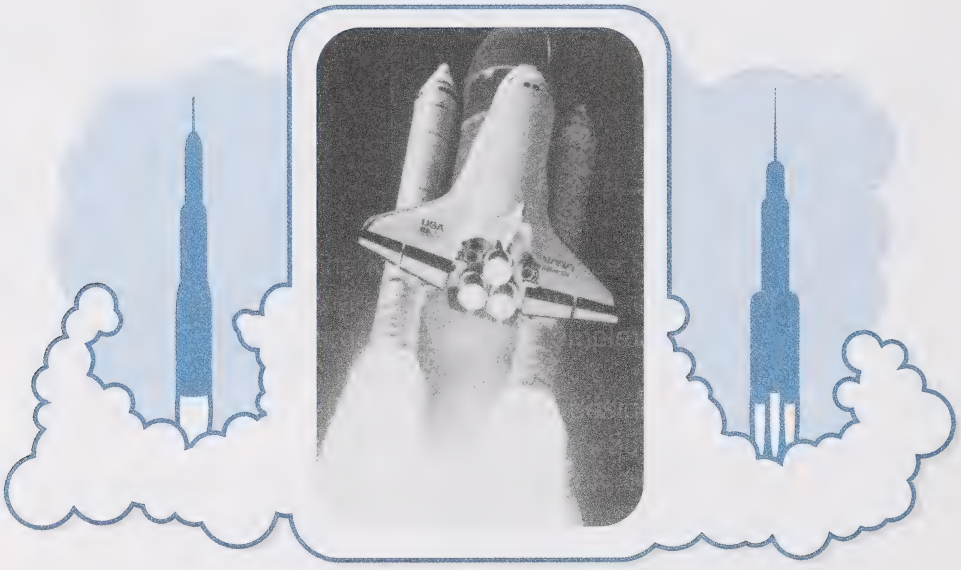
   a. The mass of the ISS will be about 4 times greater than the mass of the Mir space station was. Estimate the approximate mass of Mir.

b. When the ISS is docked with Space Shuttle *Endeavor*, their combined mass is about 500 t. Use mental computation to find the approximate mass of *Endeavor*.

Check your answers on pages 100 and 101 in the Appendix.

Questions 7 to 9 are optional. Complete these questions to discover more about the space shuttle.

7. A space shuttle's three main engines and two solid rocket boosters generate about 3.3 million kilograms of thrust at liftoff. America's first two manned launch vehicles, *Redstone* and *Atlas*, produced 35 381 kg and 163 926 kg of thrust, respectively. Estimate and then use your calculator to verify your estimates. Round your calculator answers to the nearest whole number.

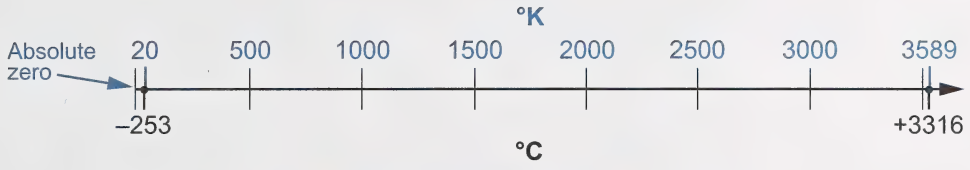


a. How many times greater than *Redstone's* thrust was *Atlas's* thrust?

b. How many times greater than the *Redstone's* thrust is a space shuttle's thrust?

c. How many times greater than the *Atlas's* thrust is a space shuttle's thrust?

8. The liquid hydrogen in a space shuttle's main engine is 20°K $(-253°C)$. When it is burned with liquid oxygen, the temperature in the engine's combustion chamber reaches 3589°K $(3316°C)$. Use the following number line to help you find the difference (in °C) between these two temperatures.



9. The combustion gases in a space shuttle's solid rocket motor are at a temperature of 3371°C, which is hot enough to boil steel! The steel case is protected so well with special insulation that the outside of the case reaches only about 54°C. How much of a difference does the insulation make? Use mental computation or a paper-and-pencil method to find the answer.

Check your answers on pages 101 to 103 in the Appendix.

Activity 3

Today you will estimate answers and then use a calculator to find the exact answers.

When travelling down a highway or along a country road, have you ever wondered how far you could travel if you put all the roads together end to end?

If you could connect all the highways and roads in Alberta, they would make a road that's long enough to take you almost halfway to the moon, a distance of about 186 150 km! Of these, 13 825 km are primary highways, 15 060 km are secondary highways, and 130 144 km are municipal roads. Use this information to answer questions 1 to 4. For each question, explain how you would estimate and then use your calculator to find the answer.

1. What is the difference between the length of the primary highways and the length of the secondary highways?

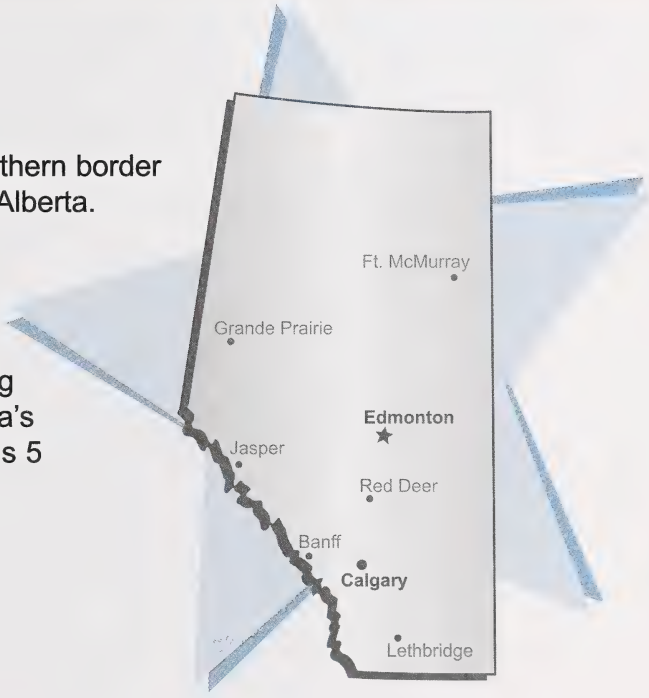
2. What is the total length of the primary highways, the secondary highways, and the municipal roads?

3. Use your answer to question 2 to find the total length of the remaining roads in the province.

4. How many times greater is the length of municipal roads than the combined length of the primary and secondary highways?

Check your answers on pages 103 and 104 in the Appendix.

It is 1223 km from the northern border to the southern border of Alberta. The distance from the western border to the eastern border ranges from 293 km to 660 km. Use this information, along with the data about Alberta's roads, to answer questions 5 and 6.



5. How many times could the total length of Alberta's roadways cover the distance from its northern border to its southern border?

6. How many times greater is the north-south distance than each of the following distances?

   a. the least west-east distance
   b. the greatest west-east distance

Check your answers on page 104 in the Appendix.

Alberta has the largest area of national parks of any province in Canada. The following table shows the areas of all five national parks in Alberta. Use this information to answer questions 7 to 9.

National Park	Area (km^2)
Banff	6 641
Elk Island	194
Jasper	10 878
Waterton Lakes	526
Wood Buffalo	31 080

7. What is the total area of national parks in Alberta?

8. The area of the largest park is how many times greater than the area of the smallest park?

9. The following table shows how much money tourists spent in Alberta in 1998. How does the total spent by all tourists compare to the total spent by all tourists from outside Alberta?

	Amount Spent by Tourists in 1998 (millions of dollars)
Albertans	2100
Other Canadians	806
Visitors from the U.S.A.	632
Visitors from Overseas	565

Check your answers on page 105 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Discuss with your home instructor the strategies you would use to estimate each of the following answers.

1. $6012 + 2995$

2. $8002 - 998$

3. 20.12×4

4. $80.12 \div 4$

Challenge Activity

Bindi has a large collection of beads. If she used the beads to make 100 necklaces, each with the same number of beads, there would be 50 beads left over. If she put 5 less beads on each necklace, she could make 110 necklaces and have no beads left over. How many beads are in Bindi's collection?

Check your answer on pages 106 and 107 in the Appendix.

Conclusion

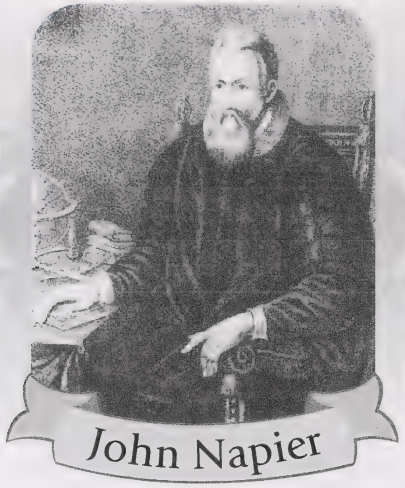
In this lesson you reviewed and extended your computational skills with whole numbers by estimating and by using mental arithmetic, pencil-and-paper techniques, and your calculator to solve problems.

It is difficult to imagine a time when calculators were not used to perform basic operations. Did you know that the first mechanical calculators were invented only a little over 350 years ago and were about the size of a microwave oven?

Turn to Assignment Booklet 2A and complete the Lesson 1 Assignment.

Keep Assignment Booklet 2A until you have completed the entire booklet.

Adding and Subtracting Decimals



Ancient manuscripts from Babylon and Egypt tell us that people carried out complicated calculations over 4000 years ago. Of course, symbols and notation have changed greatly since then. The first use of the modern decimal point is attributed to John Napier (1550–1617), a Scottish lord, astronomer, and amateur mathematician. He is remembered today, in part, for his development of logarithms—paper-and-pencil methods for performing sophisticated numerical computations.

In this lesson you will review and extend methods for adding and subtracting decimals. You will use base ten blocks and place-value charts to develop pencil-and-paper methods. You will use estimation, mental computation, pencil-and-paper computation, and your calculator to solve problems.

Activity 1

Today you will use large numbers.

NASA

In the photograph, cosmonauts and astronauts are gathered for a meal aboard the Zvezda Service Module on the International Space Station.

In the following questions you will use place-value charts and base ten blocks to develop strategies to add and subtract decimals.

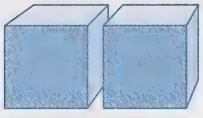
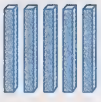
Example

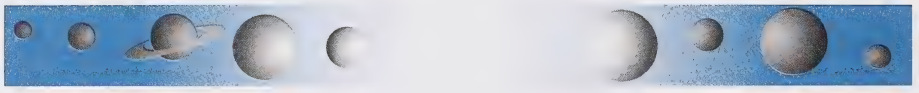
Place counters on a place-value chart to represent the number 2.157. Then, represent the same number using base ten blocks.

Place-value chart

Ones	Tenths	Hundredths	Thousandths
●●	●	●●●●●	●●●●● ●●

Base ten blocks

Large Cubes	Flats	Rods	Small Cubes
			



1. Just like on Earth, people in space don't eat exactly the same amount of food each day. However, since the weight of food supplies must be controlled, each person is allowed 1.7 kg of food (including the packaging) each day. On her first day at the space station, Commander Claire ate meals of 0.598 kg, 0.475 kg, and 0.617 kg.

   a. Write a sentence showing how you would calculate the total amount of food Claire ate on her first day at the space station.

   b. You can use base ten blocks to solve this problem. Explain which block you will use to represent 1 kg and what fraction of a kilogram will be represented by each of the other kinds of base ten blocks you use.

c. Use the least possible number of base ten blocks to represent the masses of each of the three meals. Tell how many of each kind of block you used to represent the three separate meals. Draw pictures to show your work.

d. Combine the three sets of blocks from question 1.c., regrouping as many as possible. Draw a picture to show how you regrouped the blocks. Explain.

e. Write the total amount represented by the regrouped blocks.

f. Claire ate less than the amount of food allowed for one day. Explain how you could add blocks to the set you had in question 1.d. to find out how much more Claire would have to eat in order to reach her daily limit.

2. Astronauts eat three meals every day on the space station. The following place-value chart shows the total amount of food (in kilograms) eaten by Astronaut Cale for two of his meals on his first day at the space station.

Ones	Tenths	Hundredths	Thousandths
●	●	●	●●●●●

a. Use base ten blocks to represent the same number. Draw a picture of the blocks you used.

b. Explain how using base ten blocks to represent the number is the same as using a place-value chart and counters and how it is different.

c. Cale ate 0.576 kg of food for his third meal of the day. Add extra counters that represent the amount of his third meal so what you see on your place-value chart represents the total number of kilograms Cale ate on his first day. Show your work.

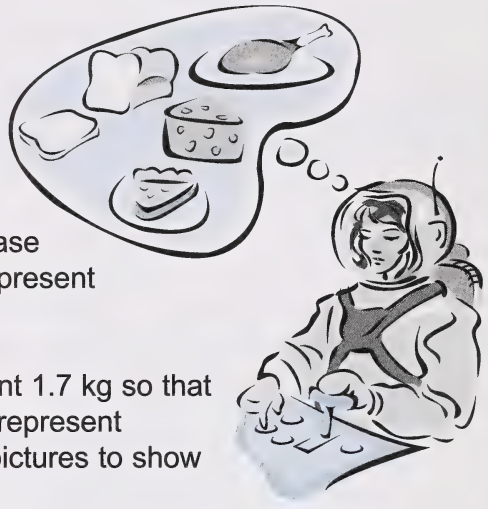
d. Regroup the counters and draw your results.

e. How many kilograms of food in total did Cale eat on his first day at the station?

f. Explain how you would add counters to the board to find how much more Cale would have to eat in order to reach his daily limit.

Check your answers on pages 107 to 110 in the Appendix.

3. Astronaut Jessie ate 0.975 kg of food for her first two meals of the day. She wanted to know the most she could eat for her third meal without going over her daily limit.



a. Represent 1.7 kg using the least number of base ten blocks possible. Draw a picture to show your blocks.

b. Draw a picture that shows the base ten blocks you would use to represent 0.975 kg.

c. Regroup the blocks that represent 1.7 kg so that you can remove the blocks that represent 0.975 kg. Remove them. Draw pictures to show your steps.

d. How many kilograms of food could Astronaut Jessie eat for her third meal of the day?

4. Astronaut Remi ate 0.543 kg of food for his first meal of the day. Astronaut Erin ate 0.487 kg of food for her first meal of the day.

a. Use a place-value chart and counters to represent the number of kilograms Astronaut Remi ate. Draw a picture to show your work.

b. You can see how much more than Erin Remi ate by removing counters. Regroup the counters on your chart so you can remove counters that represent 0.487 kg. Show your regrouping and circle the counters you removed.

c. How many more kilograms of food than Astronaut Erin did Astronaut Remi eat?

Check your answers on pages 110 to 112 in the Appendix.

5. Astronaut Chandler ate 0.567 kg of food for breakfast and 0.488 kg of food for lunch. The following place-value charts show one way you can find the total number of kilograms he ate for breakfast and lunch by regrouping counters and recording your work with numbers. Explain the reasoning for rows a. through d. and state the final answer.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
		●●●●●	●●●●● ●	●●●●● ●●	is	0	5	6	7
		●●●●	●●●●● ●●●	●●●●● ●●●	is	0	4	8	8
a.		●●●●● ●●●●	●●●●● ●●●●● ●●●●	●●●●● ●●●●● ●●●●●	is	0	9	14	15
b.		●●●●● ●●●●●	●●●●	●●●●● ●●●●● ●●●●●	is	0	10	4	15
c.	●		●●●●	●●●●● ●●●●● ●●●●●	is	1	0	4	15
d.	●		●●●●●	●●●●●	is	1	0	5	5

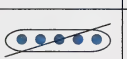
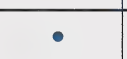
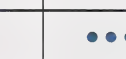
6. The following place-value charts show another way you can find the total number of kilograms Astronaut Chandler ate for breakfast and lunch by regrouping counters and recording your work with numbers. Explain the reasoning in rows a. through c. and state the final answer.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
		●●●●●	●●●●● ●	●●●●● ●●	is	0	5	6	7
		●●●●	●●●●● ●●●	●●●●● ●●●	is	0	4	8	8
a.				●●●●● ●●●●● ●●●●●	is				15
			●	●●●●●	is			1	5
b.			●●●●● ●●●●● ●●●●●	●●●●●	is			15	5
		●	●●●●●	●●●●●	is		1	5	5
c.		●●●●● ●●●●●	●●●●●	●●●●●	is		10	5	5
	●		●●●●●	●●●●●	is	1	0	5	5

Check your answers on page 112 in the Appendix.

7. On the same day, Astronaut Chandler ate 0.645 kg of food for his supper. Use two place-value charts to find the total number of kilograms of food Chandler ate that day. Draw counters on one chart and write numbers on the other to record your regrouping process. Begin by recording your final answer to question 5 in the first row, and then record the amount he ate for supper in the second row.

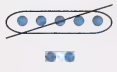
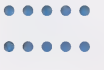
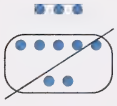
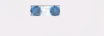
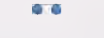
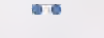
8. Astronaut Kaeli ate 0.572 kg of food for breakfast. She needs to know the greatest number of kilograms that she could eat for her remaining meals on the same day. To find this, you could start with counters that represent 1.7 kg, and remove counters that represent 0.572 kg. The following place-value charts show one way you can regroup counters and record your work with numbers. Explain what is happening in rows a. through d. Then write the final answer to the problem.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					is	1	7		
a.					is	1	6	10	
b.					is	1	6	9	10
c.					is	1	6 −5	9 −7	10 −2
d.					is	1	1	2	8

Check your answers on page 113 and 114 in the Appendix.

Questions 9 and 10 are optional. Complete these questions if you need more practice using counters and regrouping.

9. The following place-value charts show another way you can find the answer to question 8 by regrouping counters and recording your work with numbers. Explain what is happening in each row.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					is	1	7		
a.					is	1	7 −5		
b.					is	1	2		
c.					is	1	1	10	
d.					is	1	1	10 −7	
e.					is	1	1	3	
f.					is	1	1	2	10
g.					is	1	1	2	10 −2
h.					is	1	1	2	8

Check your answers on page 114 in the Appendix.

10. On the same day, Astronaut Kaeli ate 613 kg of food for lunch. Use place-value charts to find the total number of kilograms of food Kaeli could eat for her supper that day. Draw counters on one chart and write numbers on the other chart to record your regrouping process.

11. Explain how adding and subtracting decimals is the same as adding and subtracting whole numbers. How it is different?

Check your answers on pages 114 and 115 in the Appendix.

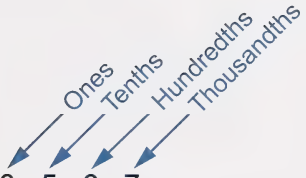
You can extend your work with place-value charts and base ten blocks to pencil-and-paper techniques for adding and subtracting decimals.

Example

In question 5 you added 0.567 and 0.488. Show one paper-and-pencil method of adding these numbers.

Step 1

Line up the decimal points.



Remember, 0. 5 6 7

$$\begin{array}{r} 0.567 \\ +\ 0.488 \\ \hline \end{array}$$

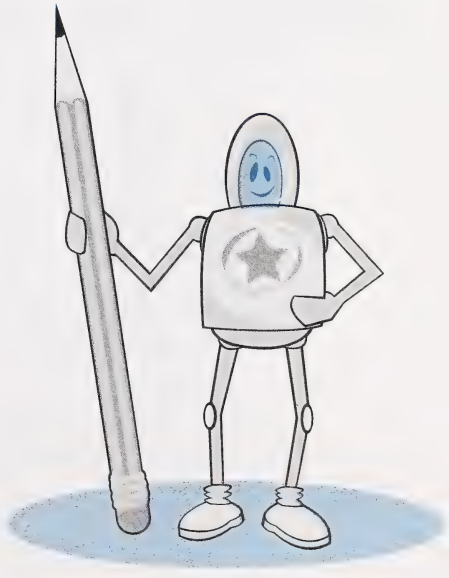
Step 2

Add the thousandths.

$$7 + 8 = 15$$
$$= 10 + 5$$

Trade 10 thousandths for 1 hundredth.

$$\begin{array}{r} {\scriptstyle 1} \\ 0.567 \\ +\ 0.488 \\ \hline 5 \end{array}$$



Step 3

Add the hundredths.

$$1+6+8=15$$
$$=10+5$$

Trade 10 hundredths for 1 tenth.

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 0.567 \\ +\ 0.488 \\ \hline 0.055 \end{array}$$

Step 4

Add the tenths.

$$1+5+4=10$$
$$=10+0$$

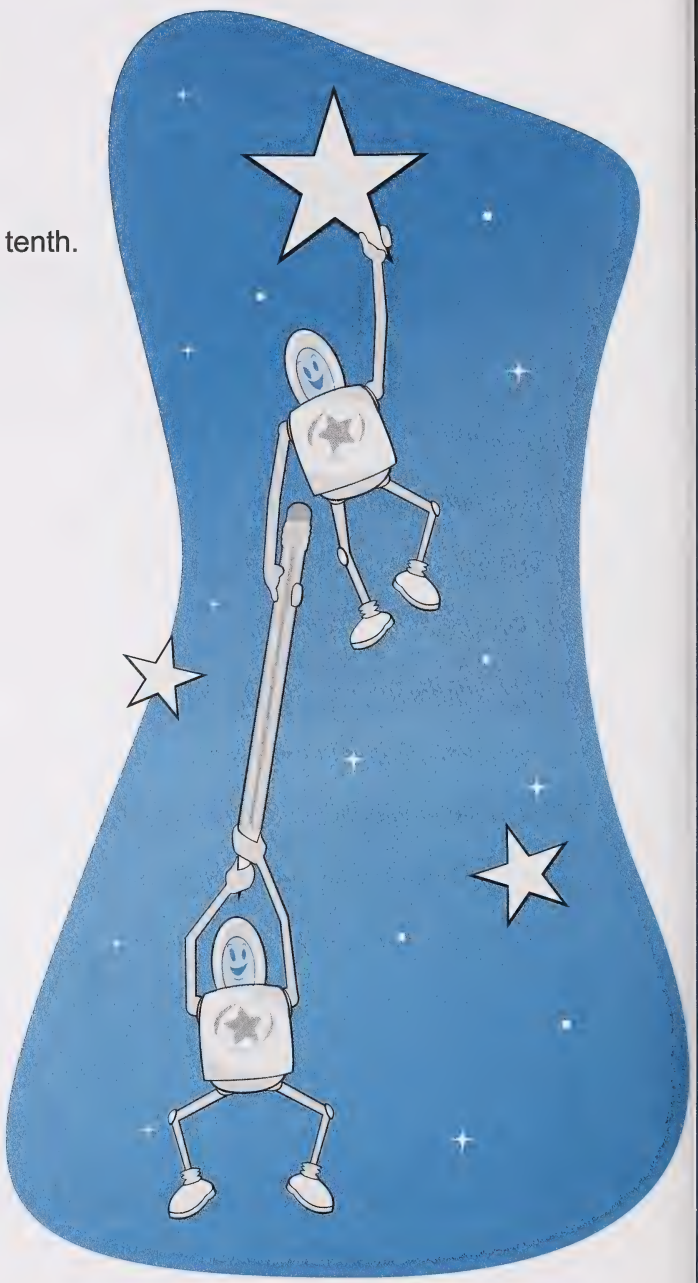
Trade 10 tenths for 1 one.

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ } \\ 0.567 \\ +\ 0.488 \\ \hline 0.055 \end{array}$$

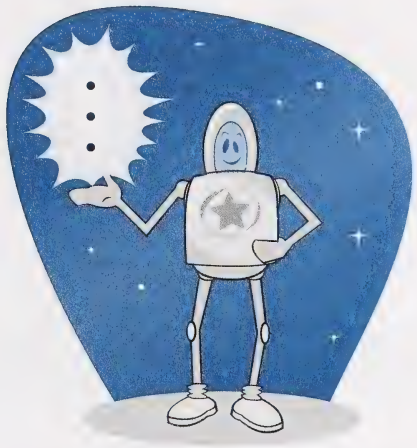
Step 5

Add the ones.

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ } \\ 0.567 \\ +\ 0.488 \\ \hline 1.055 \end{array}$$



Example



Subtract 0.423 – 0.149.

Step 1

Align the decimal points.

$$\begin{array}{r} 0.423 \\ -\ 0.149 \\ \hline \end{array}$$

Step 2

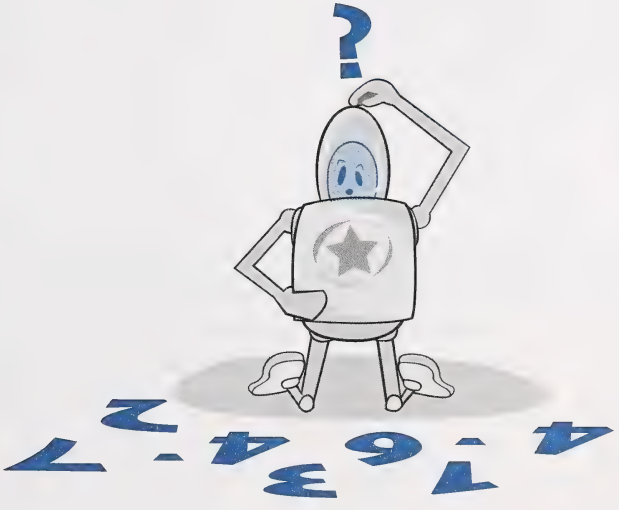
More thousandths are needed. Trade 1 hundredth for 10 thousandths. Subtract the thousandths.

$$\begin{array}{r} {\scriptstyle 1\ 13} \\ 0.4\not{2}\not{3} \\ -\ 0.1\,4\,9 \\ \hline 4 \end{array}$$

Step 3

More hundredths are needed. Trade 1 tenth for 10 hundredths. Subtract the hundredths.

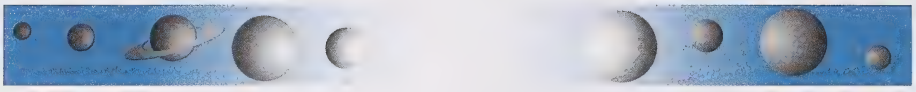
$$\begin{array}{r} {\scriptstyle 3\ 11\ 13} \\ 0.\not{4}\not{2}\not{3} \\ -\ 0.1\,4\,9 \\ \hline 7\,4 \end{array}$$



Step 4

Subtract the tenths.

$$\begin{array}{r} {\scriptstyle 3\ 11\ 13} \\ 0.\cancel{4}\cancel{2}\cancel{3} \\ -\ 0.1\ 4\ 9 \\ \hline 0.2\ 7\ 4 \end{array}$$



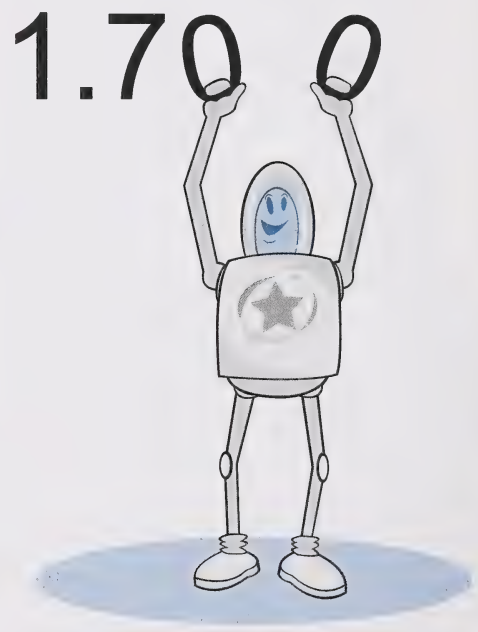
Example

Show how you would use a pencil-and-paper method to find $1.7 - 0.572$.

Step 1

Align the decimal points.

$$\begin{array}{r} 1.7 \\ -\ 0.572 \\ \hline \end{array}$$



Step 2

Write 1.7 as 1.700.

$$\begin{array}{r} 1.700 \\ -\ 0.572 \\ \hline \end{array}$$

Step 3

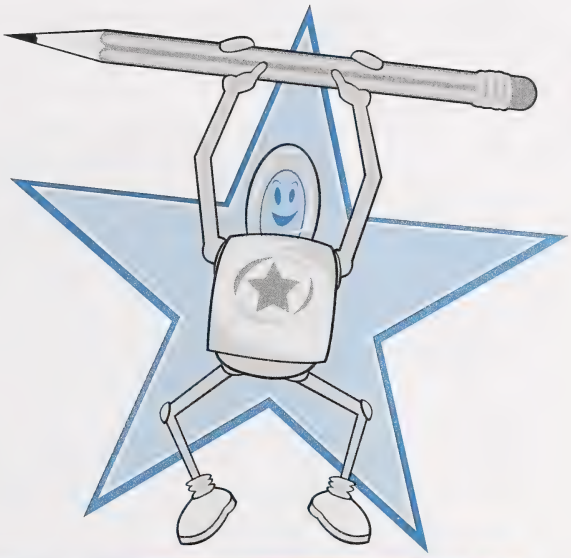
More thousandths are needed. You will have to trade 1 hundredth for 10 thousandths. However, since there are 0 hundredths, you must first trade 1 tenth for 10 hundredths.

$$\begin{array}{r} {\scriptstyle 6\ 10} \\ 1.\cancel{7}\cancel{0}\ 0 \\ -\ 0.5\ 7\ 2 \\ \hline \end{array}$$

Step 4

Now trade 1 hundredth for 10 thousandths.

$$\begin{array}{r} {\scriptstyle 9} \\ {\scriptstyle 6\ 10\ 10} \\ 1.7\,0\,0 \\ -\ 0.5\,7\,2 \\ \hline \end{array}$$



Step 5

Complete the subtraction.

$$\begin{array}{r} {\scriptstyle 9} \\ {\scriptstyle 6\ 10\ 10} \\ 1.7\,0\,0 \\ -\ 0.5\,7\,2 \\ \hline 1.1\,2\,8 \end{array}$$

12. Perform the indicated operation using a pencil-and-paper method.

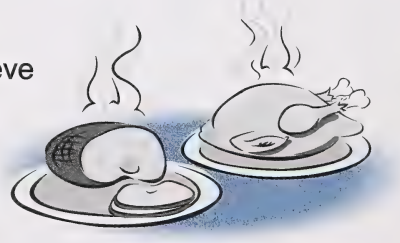
a.	3.625	**b.**	6.123	**c.**	5.198
	+ 8.918		+ 4.387		+ 2.143
d.	6.123	**e.**	3.157	**f.**	2.600
	− 4.614		− 1.029		− 1.921

Check your answers on page 115 in the Appendix.

Activity 2

Today you will solve problems involving addition and subtraction of decimals.

In many supermarkets, bulk purchases such as produce, candy, and deli foods are sold by the kilogram and weighed to the nearest one-thousandth of a kilogram. Remember, a gram is a thousandth of a kilogram and is approximately the **mass** of a raisin.



1. Sliced chicken and sliced ham were on special at the deli for the same price. Steve bought 0.412 kg of sliced chicken and 1.259 kg of sliced ham.

   a. Use estimation to decide if Steve's total purchase was less than 2 kg or greater than 2 kg. Explain your reasoning.

   b. Use a pencil-and-paper method to find the exact mass of the meat that Steve purchased. Show your work.

c. Show how you can use a pencil-and-paper method for subtraction to check your answer.

2. Sydney bought 1.500 kg of green apples and 2.347 kg of red apples. Use mental computation to find the exact total mass of the apples Sydney bought. Explain your thinking.

3. A recipe for stew requires 2 kg of mixed vegetables. Ameen went to the store and bought the following vegetables to make this recipe: 0.567 kg of potatoes, 0.445 kg of carrots, 0.458 kg of turnip, 0.25 kg of onions, and 0.215 kg of celery.

a. Estimate the total number of kilograms of vegetables that Ameen bought to make stew. Explain your reasoning.

b. Use your calculator to find the exact mass of the vegetables that Ameen bought.

c. Explain how you can work backward with your calculator by using the subtraction key over and over to check your answer.

Check your answers on pages 116 and 117 in the Appendix.

4. Lee bought ham at the deli. He asked to have part of it thickly sliced and the rest thinly shaved. Of the total 1.55 kg of ham, 0.865 kg was shaved ham.

a. Estimate how many kilograms of sliced ham Lee bought. Explain your reasoning.

b. Use a pencil-and-paper method to find the exact mass of the sliced ham Lee bought. Show your work.

c. Show how you can use a pencil-and-paper method for addition to check your answer.

5. A deli clerk started with a large block of cheese that had a mass of 3.75 kg. After cutting a piece of cheese from it, the remaining block had a mass of 3.499 kg. Use mental computation to find the mass of the piece of cheese that was cut from the large block. Explain your reasoning.

6. A submarine sandwich has 0.65 kg of meat in it. It has 0.335 kg of chicken, 0.196 kg of ham, and the rest of the meat is roast beef.

   a. Estimate the mass of roast beef in the sandwich. Explain your reasoning.

   b. Use your calculator to find the exact mass of roast beef in the sandwich. Show your work.

   c. Explain how you could use your calculator with addition to check your answer.

Check your answers on pages 117 and 118 in the Appendix.

7. Decide whether to use mental computation, a pencil-and-paper method, or your calculator after making an estimate. Explain why you chose the method you did, and show your work.

   a. Brad bought 0.225 kg of roast turkey, 0.347 kg of pepper ham, and 0.309 kg of salami. Find the total number of kilograms of deli meat that Brad bought.

   b. Genni put some oranges into two bags. When the first bag was put on the checkout scale, it read 1.3 kg. When the second bag was added to the scale, the total was 2.528 kg. Find the mass of the second bag of oranges.

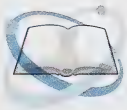
   c. Raman bought 0.356 kg of gumdrops and 0.549 kg of jellybeans. Find the total mass of candy that Raman bought.

8. When do you find it easier to do computation mentally, rather than with pencil and paper or a calculator?

Check your answers on page 119 in the Appendix.

Sharing Time

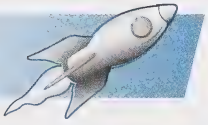
Now it's time to show your home instructor what you have been learning.



Turn to page 155 of the Practice and Homework Book and complete question 5. Then turn to page 157 and complete question 6.

Discuss your answers with your home instructor.

Activity 3



Today you will practise the addition and subtraction of decimals by solving problems about money and finance.

Do you like looking through flyers and catalogues, thinking of gifts you might give or presents you may receive? Which part of a catalogue do you turn to first? Is it the winter boot section or the section on tires and car accessories? Or perhaps, the pages devoted to mops and brooms!

Turn to pages 72 and 73 in your textbook. Use the catalogue items shown to answer the questions in this activity. The costs include GST.

1. Imagine you won $250 in a raffle. You decide to buy six presents for your friends. You want the presents gift wrapped and sent by Speedy Air Delivery.

a. Explain how you would use estimation to decide what you can buy.

b. Use the following order form to list your six chosen items and find the total cost.

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	
Gift Wrap ($2.50 per item)	
Shipping and Handling (see chart)	
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	
Total Cost of Order	

c. How much money would you have left over?

2. Suppose you earned $80 shovelling snow for your neighbours. Since you are buying gifts for yourself, you do not need gift wrapping, but you do want Speedy Air Delivery. Use the following order form.

   a. Explain how you would use estimation to find the greatest number of different catalogue items you could order.

   b. List the greatest number of items and find the total cost.

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	
Gift Wrap ($2.50 per item)	
Shipping and Handling (see chart)	
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	
Total Cost of Order	

   c. What is the single most expensive item you could buy? Explain how you decided.

Check your answers on pages 120 to 123 in the Appendix.

3. Dwayne won a $150 mail-order shopping spree. He is not in a hurry to get the items, so he will not use Speedy Air Delivery, but he wants two of the items gift wrapped.

   a. Explain how you would use estimation to decide the greatest number of different items Dwayne can buy.

   b. Use the following order form to list the items and find the total cost.

   c. How much money would Dwayne have left?

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	
Gift Wrap ($2.50 per item)	
Shipping and Handling (see chart)	
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	
Total Cost of Order	

4. Massa wants to buy the touch tone phone, the jigsaw puzzle, and the CD tower that holds 50 CDs as presents for members of his family.

a. Use the following order form to find the total Massa must pay if he decides to have the presents gift wrapped and uses Speedy Air Delivery.

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	
Gift Wrap ($2.50 per item)	
Shipping and Handling (see chart)	
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	
Total Cost of Order	

b. How much money could Massa save if he decides not to have the presents gift wrapped and not to use Speedy Air Delivery?

Check your answers on pages 123 to 125 in the Appendix.

Questions 5 to 8 are optional. Complete these questions if you need more practice using the order forms.

5. Use the information shown on the catalogue order forms, along with the catalogue prices from pages 72 and 73 in your textbook, to answer the following.

a. Find the greatest total you could spend when ordering four different catalogue items.

b. Find the least total you could spend when ordering four different catalogue items.

6. Suppose you want to buy the shower radio shown on page 72. A friend told you that a nearby store has the same radio for $27.50. Use the information shown on the order forms to decide whether you would order the radio from the catalogue or buy it at the store. Explain your choice.

7. Novlett saved $125 and she wants to order a bath robe in child's size medium, a pair of running shoes, and a shower radio. Use the information on the order form to determine if she has enough money. Explain.

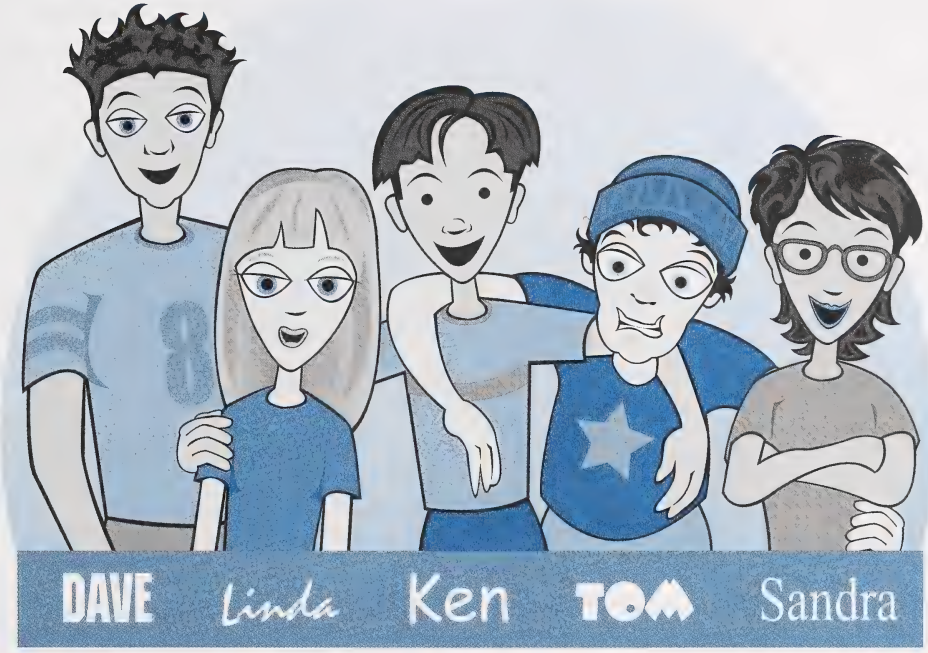
8. Suppose you wanted to buy one of each item that has a separate order number from the catalogue on pages 72 and 73 in your textbook.

a. Explain how you would estimate the merchandise total of your order.

b. Use your calculator to find the merchandise total you would enter on your order form.

Check your answers on pages 126 and 127 in the Appendix.

Challenge Activity



Five friends owed each other money.

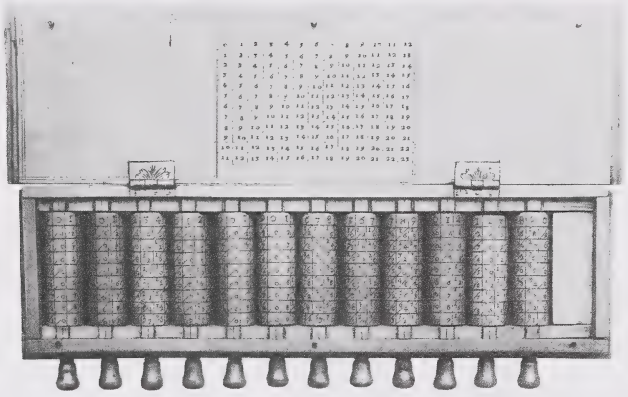
- Dave owed Sandra $1.25.
- Tom owed Ken $1.50.
- Ken owed Sandra $2.75.
- Sandra owed Linda $3.10.
- Tom owed Linda $5.15.
- Linda owed Ken $1.35.
- Tom owed Sandra $2.80.
- Ken owed Tom $1.95.
- Tom owed Dave $3.05.

None of them had any money to pay each other back. However, at the end of the week, they each received $12 allowance. How much money did each friend have after all debts were paid?

Check your answer on pages 128 and 129 in the Appendix.

Conclusion

In this lesson you reviewed and extended methods for adding and subtracting decimals. You used base ten blocks and place-value charts to develop pencil-and-paper methods. You used estimation, mental computation, pencil and paper, and your calculator to solve problems.



Have you wondered what it would be like to do complicated arithmetic without a computer or calculator! The calculating machine shown above is an invention of John Napier (1550–1617). Napier was a mathematician, physicist, engineer, astronomer, and theologian.

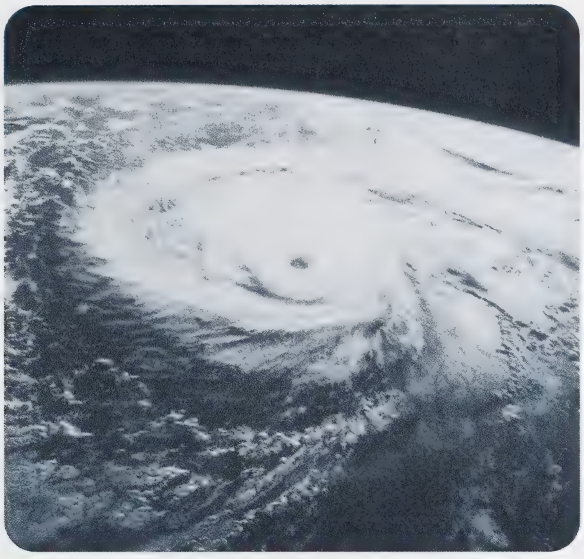
If you have access to the Internet, you can find out more about Napier at the following website:

http://www-groups.dcs.st-and.ac.uk:80/~history/Mathematicians/Napier.html

Turn to Assignment Booklet 2A and complete the Lesson 2 Assignment.

When you are finished, submit Assignment Booklet 2A to your teacher to be marked.

Multiplying and Dividing Decimals



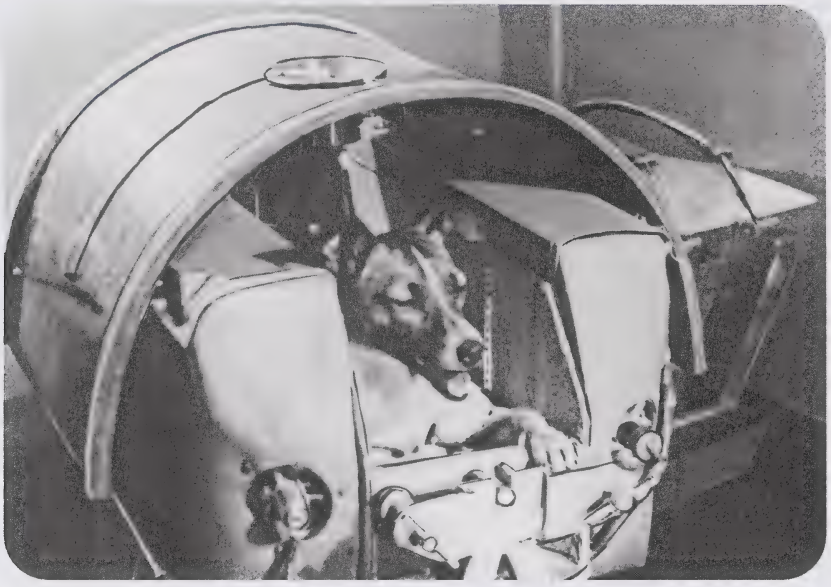
From space, a hurricane appears as a spiral cloud formation with the eye of the storm at the centre of the spiral. Meteorologists track the path and speed of the storm in order to warn people where it is headed and when it is likely to arrive.

Suppose the storm in the photograph was headed directly towards a town on the coast of Florida at a speed of 18.5 km/h. If you were working in a weather office, what would you tell the residents of the town? If the town is 85 km from the leading edge of the storm, how many hours do the people in the town have to prepare before the storm arrives? How far from the town will the hurricane be in 2.5 h? To answer these questions, you need to be able to multiply and divide decimal numerals.

In this lesson you will review and extend methods for multiplying and dividing decimals. You will use base ten blocks and place-value charts to develop pencil-and-paper methods. You will use estimation, mental computation, pencil-and-paper computation, and your calculator to solve problems.

Activity 1

Today you will explore strategies for multiplying decimals.



BETTMANN/CORBIS/MAGMA

You may be surprised to know that the first astronaut was a female dog named Laika, which means "barker" in Russian.

When Laika went into orbit in *Sputnik II* in 1957, she experienced weightlessness.

You can find out more about Laika at the following website:

http://starchild.gsfc.nasa.gov/docs/StarChild/space_level2/laika.html

If you took a tour through the solar system, your **mass** would remain the same throughout the trip, but your **weight** would be different on the moon and on each of the planets. This is because weight is affected by gravity, a force that varies from planet to planet. Weight is measured in newtons (N). For example, a small apple weighs about 1 N and 1 L of milk weighs about 10 N. Since Laika first orbited Earth on the Russian satellite *Sputnik II*, there have been many animal astronauts, including dogs, cats, monkeys, rats, mice, flies, and jellyfish.

1. Three gerbils, each weighing 1 N on Earth, were sent to the moon, where they had only 0.166 of their weight on Earth.

a. Write an addition number sentence and a multiplication number sentence that you would use to find the total weight, in newtons, of the three gerbils on the moon.

b. You can use base ten blocks to solve this problem. Explain which block you will use to represent 1 N, and what fraction of a newton will be represented by each of the other base ten blocks you use.

c. Use the least possible number of base ten blocks to represent the weight of each of the three gerbils on the moon. Tell how many of each kind of block you used to represent each of the three gerbils. Draw pictures to show your work.

d. Combine the three sets of blocks and regroup as many as possible. Draw a picture to show how you regrouped the blocks. Explain.

e. Write the total weight represented by the regrouped blocks.

2. The following place-value chart shows what an object that weighs 1 N on Earth would weigh on Neptune.

Ones	Tenths	Hundredths	Thousandths
●	●	●●	●●●●●

   a. A rat that weighs 5 N on earth was sent to Neptune. Write an addition number sentence and a multiplication number sentence you could use to find the rat's total weight, in newtons, on Neptune.

   b. Explain what counters you would add to your place-value chart so that it represents the rat's weight on Neptune.

   c. Add the counters and show your work by drawing on a place-value chart.

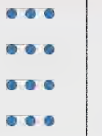
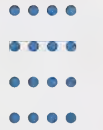
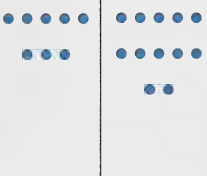
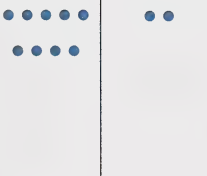
   d. Regroup the counters and draw your results on a place-value chart.

   e. What was the rat's weight, in newtons, on Neptune?

Check your answers on pages 129 to 131 in the Appendix.

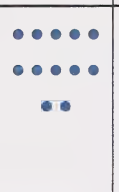
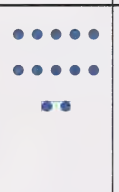
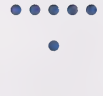
3. A hamster that weighs 4 N on Earth would weigh 2.364 times as much on Jupiter. Estimate the hamster's weight, in newtons, when it lands on Jupiter. Explain.

4. The following place-value charts show one way of finding the hamster's weight on Jupiter by regrouping counters and recording your work with numbers. Explain the reasoning for each row.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					is →	2 × 4	3 × 4	6 × 4	4 × 4
a.					is →	8	12	24	16
b.					is →	9	2	24	16
c.					is →	9	4	4	16
d.					is →	9	4	5	6

e. Write the final answer to the problem (the hamster's weight on Jupiter).

5. The following place-value charts show another way you can find the hamster's weight on Jupiter by regrouping counters and recording your work with numbers. Explain the reasoning for each row.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					is →	2 × 4	3 × 4	6 × 4	4 × 4
a.					is →	8	12	24	16
b.					is →	8	12	25	6
c.					is →	8	14	5	6
d.					is →	9	4	5	6

e. Write the final answer to the problem (the hamster's weight on Jupiter).

f. Use a pencil-and-paper method to find 4×2.364.

Check your answers on pages 132 and 133 in the Appendix.

6. A mouse that weighs 3 N on Earth would weigh 1.125 times as much on Neptune. Estimate the mouse's weight, in newtons, when it lands on Neptune. Explain.

7. **a.** Use place-value charts to find the mouse's weight, in newtons, on Neptune. Draw counters on one chart and write numbers on another to record your regrouping process.

   b. Use a paper-and-pencil method to find 3×1.125.

   c. Write the final answer (the mouse's weight on Neptune).

8. On Saturn, objects weigh only 0.916 of what they weigh on Earth. On Neptune, they weigh 1.125 times what they weigh on Earth. A rabbit weighs 64 N on Earth.

   a. Doris estimated the rabbit would weigh about 60 N on Saturn and about 70 N on Neptune. Are Doris's estimates reasonable? Explain.

   b. The decimal key on Doris's calculator was not working, but she said she could still use her calculator without using the decimal key to find the rabbit's weight on Saturn and on Neptune.

Keystrokes	ON/C	64	×	916	=	1125	=
Display	0	64	64	916	58624	1125	72000

   Explain how Doris used her calculator.

   c. Explain how Doris used her estimated answers to decide where to put the decimal points. Give the rabbit's weight on Saturn and on Jupiter.

   d. Verify your answers by using the decimal key and the constant multiplication feature on your calculator. Show your work. (Tell what you entered and what the display read each time.)

Check your answers on pages 133 and 134 in the Appendix.

Questions 9 and 10 are optional. Complete these questions if you want to find out more about the weights of objects on Jupiter and Uranus.

9. On Mars, objects weigh only 0.377 of what they weigh on Earth. On Jupiter, they weigh 2.364 times what they weigh on Earth. Before leaving Earth, a puppy weighed 71 N.

a. Estimate the puppy's weight on Mars and on Jupiter. Explain.

b. Find the puppy's weight on Mars and on Jupiter by using Doris's method of multiplying whole numbers and then using your estimates to place the decimal points. Show your work.

c. Verify your answers by using the decimal key and the constant multiplication feature on your calculator. Show your work. (Tell what you entered and what the display read each time.)

10. On Uranus, objects weigh only 0.889 of what they weigh on Earth. Before leaving Earth, a monkey weighed 80 N, a cat weighed 58 N, and a rat weighed 9 N.

a. Estimate the monkey's weight, the cat's weight, and the rat's weight on Uranus. Explain.

b. Find the monkey's weight, the cat's weight, and the rat's weight on Uranus by using Doris's method of multiplying whole numbers and then using your estimates to place the decimal points. Show your work.

c. Using the decimal key on your calculator, verify your answers. Show your work.

11. How is multiplying decimals like multiplying whole numbers? How is it different?

Check your answers on pages 134 and 135 in the Appendix.

There are many ways to multiply decimal numbers using pencil and paper. One approach is based on the work you did in the previous questions.

Example

Multiply 2.325 by 6.

Step 1: Multiply the thousandths.

$$\begin{array}{r} {\scriptstyle 3} \\ 2.325 \\ \times \quad 6 \\ \hline 0 \end{array} \qquad 6 \times 5 = 30$$

Step 2: Multiply and add the hundredths.

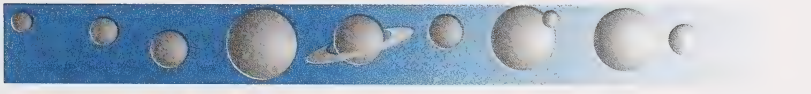
$$\begin{array}{r} {\scriptstyle 1\,3} \\ 2.325 \\ \times \quad 6 \\ \hline 50 \end{array} \qquad (6 \times 2) + 3 = 12 + 3 = 15$$

Step 3: Multiply and add the tenths.

$$\begin{array}{r} {\scriptstyle 1\,1\,3} \\ 2.325 \\ \times \quad 6 \\ \hline 950 \end{array} \qquad (6 \times 3) + 1 = 18 + 1 = 19$$

Step 4: Multiply and add the ones. Then, place the decimal point in the answer. When you mulitiply a decimal numeral by a whole number, the answer will have the same number of decimal places as the decimal numeral has.

$$\begin{array}{r} {\scriptstyle 1\,1\,3} \\ 2.325 \\ \times \quad 6 \\ \hline 13.950 \end{array} \qquad (6 \times 2) + 1 = 12 + 1 = 13$$



12. Use a pencil-and-paper method to find each product.

a. 6.236×2

b. 8.386×3

c. 2.498×8

Check your answers on pages 135 and 136 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 163 of the Practice and Homework Book and complete question 4.

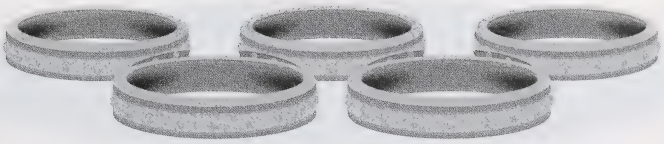
Discuss your answers with your home instructor.

Activity 2

Today you will investigate the division of a decimal by a whole number.

Since ancient times, gold has been used to make money, jewellery, and dishes. Today, its chemical properties have applications in dentistry, technology, and medicine. Both unrefined and refined gold may contain other metals, such as silver or copper. The fineness of gold is measured by the number of parts of pure gold per thousand.

1. A 1-kg gold nugget described as being 885-fine means that 0.885 kg of the nugget is pure gold (885 g out of 1000 g). All of the pure gold in the nugget was removed, and 5 identical bracelets were made from it.

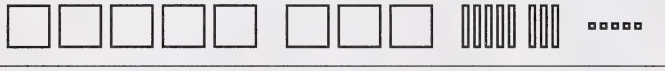
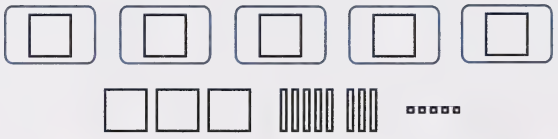
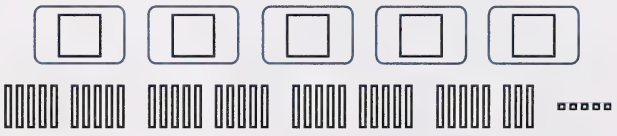
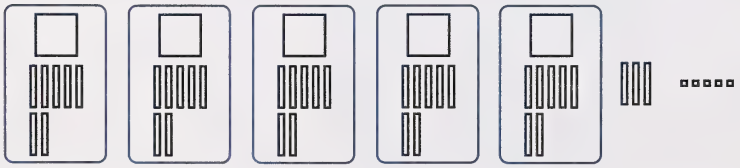


a. Estimate how many kilograms of pure gold were used for each bracelet. Explain.

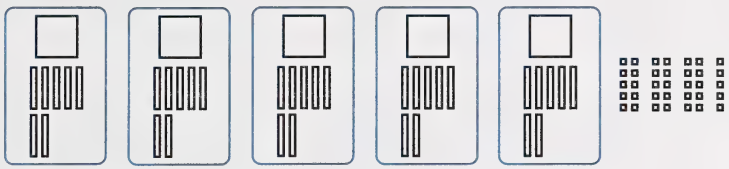
b. Inge used the following set of base ten blocks to represent the number of kilograms of pure gold removed from the nugget.

How many kilograms does one of each kind of block represent?

2. The following pictures show how Inge regrouped the blocks and recorded his work with pencil and paper to solve the problem in question 1. Explain what is happening in each row.

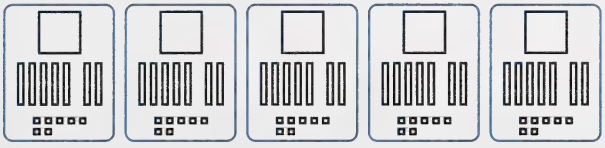
		$5\overline{)0.885}$
a.		$\begin{array}{r} 0.1 \\ 5\overline{)0.885} \\ \underline{5} \\ 3 \end{array}$
b.		$\begin{array}{r} 0.1 \\ 5\overline{)0.885} \\ \underline{5}\downarrow \\ 38 \end{array}$
c.		$\begin{array}{r} 0.17 \\ 5\overline{)0.885} \\ \underline{5}\downarrow \\ 38 \\ \underline{35} \\ 3 \end{array}$

d.



$$\begin{array}{r} 0.17 \\ 5\overline{)0.885} \\ \underline{5} \\ 38 \\ \underline{35} \\ 35 \end{array}$$

e.



$$\begin{array}{r} 0.177 \\ 5\overline{)0.885} \\ \underline{5} \\ 38 \\ \underline{35} \\ 35 \\ \underline{35} \\ 0 \end{array}$$

f. How much gold, in kilograms, was used for each bracelet?

3. A 1-kg gold bar that was 748-fine was divided into 4 identical smaller bars.

a. Estimate how many kilograms of pure gold would be in each of the four smaller bars.

b. Solve the problem using base ten blocks and draw pictures that show the steps you took.

c. Record, with numbers, the steps you used with the blocks to show how you could use a pencil-and-paper method to find the answer.

d. How many kilograms of pure gold could be extracted from each of the smaller bars?

Check your answers on pages 136 and 137 in the Appendix.

4. Gold leaf is made by hammering gold into thinner and thinner sheets. Gold leaf is used to decorate materials such as wood, leather, and glass. Some gold leaf, only 0.0001 mm thick, is so thin that it is translucent.

   a. A picture framer bought 3 packages of gold leaf. The total thickness of the gold leaves was 0.585 mm. Estimate the thickness, in millimetres, of all the gold leaves in each package. Explain.

   b. Find the total thickness, in millimetres, of all the gold leaves in each package. Do this by copying and completing the following place-value chart in your notebook. Draw pictures that show the steps you took with the counters and how you recorded them with pencil and paper.

Picture Showing the Counters Left to Divide			Picture Showing the Counters Put in Each of the Three Sets			Pencil-and-Paper Work
Tenths	Hundredths	Thousandths	Tenths	Hundredths	Thousandths	
●●●●●	●●●●● ●●●	●●●●●				$3\overline{)0.585}$

   c. What was the total thickness, in millimetres, of the gold leaves in one package?

5. One micrometre is equal to one-thousandth of a millimetre.

   a. Write your answer to question 5.c. in micrometres. Explain.

   b. Each gold leaf package contained 20 "books." Use your answer to question 5.c. to estimate the total thickness, in micrometres, of the gold leaves in each book. Explain.

   c. Use your calculator to find the total thickness, in micrometres, of the leaves in each book.

6. Each gold leaf book contains 25 leaves.

a. Use your answer to question 6.c. to estimate the thickness, in micrometres, of each gold leaf. Explain.

b. Use your calculator to find the thickness, in micrometres, of each gold leaf.

c. Estimate how many gold leaves you would need to make a stack that is 1 mm thick.

7. Three grams of gold were stretched into 9.828 km of fine wire.

a. Estimate the number of kilometres of fine wire that can be made from 1 g of gold. Explain.

b. Use a pencil-and-paper method to find the answer. Show your work.

c. How many kilometres of fine wire can be made from 10 g of gold? Explain.

8. Gold is a heavy metal. One cubic centimetre of gold has a mass of 19.319 g. This is 7 times heavier than a particular aluminum alloy.

a. Estimate the mass of a bracelet made from 1 cm^3 of the aluminum alloy. Explain.

b. Use a pencil-and-paper method to find the answer to the nearest hundredth of a gram. Show your work.

c. Write the mass of the bracelet.

9. Bill bought 3 identical Canadian gold coins. Their total mass was 93.311 g.

a. Estimate the mass of one of these coins. Explain.
b. Use a pencil-and-paper method to find the answer. Show your work.
c. Write the mass of one coin to the nearest thousandth of a gram.

Check your answers on pages 138 to 141 in the Appendix.

In the preceding questions, you explored different methods for dividing decimals by whole numbers. One of these methods was a pencil-and-paper approach.

Example

Here is one way to divide 7.602 by 3.

Step 1

Divide the ones. Record 2 ones. Multiply 3 by 2 and subtract.

$$\begin{array}{r} 2. \\ 3\overline{)7.602} \\ \underline{6} \\ 1 \end{array}$$

Step 2

Bring down the tenths. Divide 16 tenths by 3. Record 5 tenths. Multiply 3 by 5 and subtract.

$$\begin{array}{r} 2.5 \\ 3\overline{)7.602} \\ \underline{6}\downarrow \\ 16 \\ \underline{15} \\ 1 \end{array}$$

Step 3

Bring down the hundredths. Divide 10 hundredths by 3. Record 3 hundredths. Multiply 3 by 3 and subtract.

$$
\begin{array}{r}
2.53 \\
3\overline{)7.602} \\
\underline{6} \\
16 \\
\underline{15} \\
10 \\
\underline{9} \\
1
\end{array}
$$

Step 4

Bring down the thousandths. Divide 12 thousandths by 3. Record 4 thousandths. Multiply 3 by 4 and subtract.

$$
\begin{array}{r}
2.534 \\
3\overline{)7.602} \\
\underline{6} \\
16 \\
\underline{15} \\
10 \\
\underline{9} \\
12 \\
\underline{12} \\
0
\end{array}
$$

The method is similar when you divide by a two-digit whole number.

Example

Dive 59.11 by 23.

Step 1

Divide 59 by 23. Record 2 ones. Mulitply 23 by 2 and subtract.

$$
\begin{array}{r}
2 \\
23\overline{)59.11} \\
\underline{46} \\
13
\end{array}
$$

Step 2

Bring down the tenths. Divide 131 by 23. Record 5 tenths. Multiply 23 by 5 and subtract.

$$\begin{array}{r} 2.5 \\ 23\overline{)59.11} \\ \underline{46} \\ 13\,1 \\ \underline{11\,5} \\ 1\,6 \end{array}$$

Step 3

Bring down the hundredths. Divide 161 by 23. Record 7 hundredths. Multiply 23 by 7 and subtract.

$$\begin{array}{r} 2.57 \\ 23\overline{)59.11} \\ \underline{46} \\ 13\,1 \\ \underline{11\,5} \\ 1\,61 \\ \underline{1\,61} \\ 0 \end{array}$$

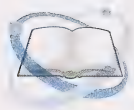
10. Use a pencil-and-paper technique to divide.

a. $2\overline{)2.526}$ **b.** $3\overline{)7.092}$ **c.** $5\overline{)6.970}$

d. $21\overline{)76.02}$ **e.** $52\overline{)187.2}$ **f.** $13\overline{)4.68}$

Check your answers on page 142 in the Appendix.

Sharing Time



Turn to page 166 of the Practice and Homework Book and answer question 5.

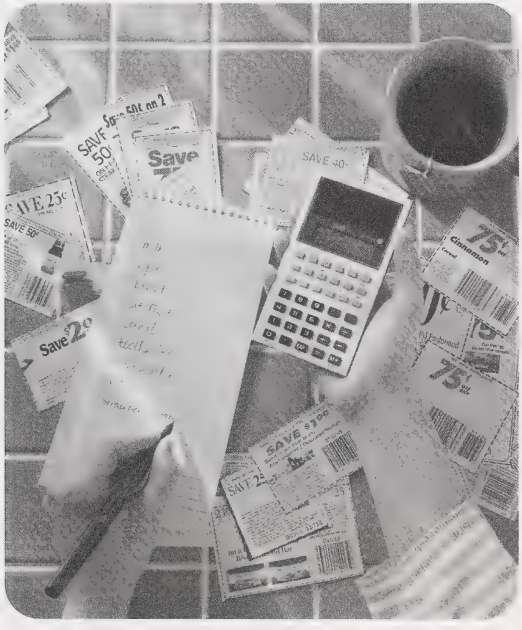
Discuss your answers with your home instructor.

Activity 3

Today you will practise multiplying and dividing decimals when solving problems involving money.

Do you help with the grocery shopping? When comparing two or more similar items, which item do you buy? Is it the popular brand, or is it the least expensive? If items come in different sized containers, how can you tell which is the cheapest?

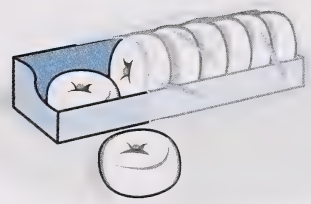
In this activity you will explore the skills of multiplying and dividing decimal numbers.



Multiplication and division are called inverse operations because what one of them does can be undone by the other. You've probably used this relationship to check your division answers by multiplying and to check your multiplication answers by dividing.

Here's another way to use this relationship. Sometimes a problem can be solved by using either multiplication or division—you can choose the operation that's easier!

Example



Warehouse Foods sells a package of 10 dozen Tiny Doughnuts for $28.95. Bulk Bakery sells Tiny Doughnuts for $0.25 each. Which is the better buy?

One way to decide is to find the cost of 10 dozen Tiny Doughnuts at Bulk Bakery.

- You could multiply $120 \times \$0.25 = \$30.00$.

or

- You could divide, using the following reasoning: At $0.25 each, every 4 doughnuts would cost $1. Since $120 \div 4 = 30$, $30 would be the cost at Bulk Bakery.

Example

Fresh Foods sells a 0.5-kg bag of grapes for $1.25. Pete's Produce sells 1 kg of the same kind of grapes for $2.79. Which is the better buy?

One way to decide is to find the cost of 1 kg of grapes at Fresh Foods.

- You could divide $\$1.25 \div 0.5$ kg = $\$2.50$/kg

or

- You could multiply, using the following reasoning: If 0.5 kg costs $2.25, then 1 kg would cost $2 \times \$2.25 = \$2.50$/kg.

1. Turn to pages 82 and 83 in your textbook. Use the grocery store ads to decide which store has the better price for each of the items. Show how you used multiplication or division to decide. In most cases, you will not have to find the exact answer—an estimate will be sufficient. Copy and complete the table in your notebook.

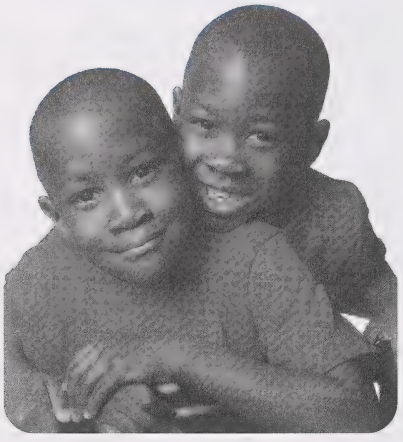
Item	Work Done to Decide Best Buy	Best Buy	
		Food Mart	Grocery Land
2% Milk			
Orange Juice			
Tuna Fish			
String Cheese			
Kidney Beans			
Pita Bread			
Crispy Cereal			
Grape Jelly			
Rice			
Pierogis			
Salmon			
Laundry Detergent			
Apples			
Peanut Butter			
Toothpaste			

Burritos			
Dog Food			
Ketchup			
Ice Cream			
Pretzels			

2. If the 20 items in question 1 were on your shopping list, would you shop at Food Mart or Grocery Land? Explain.

Check your answers on pages 142 to 145 in the Appendix.

Challenge Activity



On the twins' birthday, some of their cousins treated them to lunch. Everyone ordered the same food and the cousins split the bill equally. This meant that each cousin paid for his or her own meal plus an extra $3.25 to cover the cost of the twins' food. The total bill was $78. How many people, including the twins, went to lunch?

Check your answers on pages 145 and 146 in the Appendix.

Conclusion

In this lesson you reviewed and extended methods for multiplying and dividing decimals. You used base ten blocks and place-value charts to develop pencil-and-paper methods. You used estimation, mental computation, pencil-and-paper computation, and your calculator to solve problems.

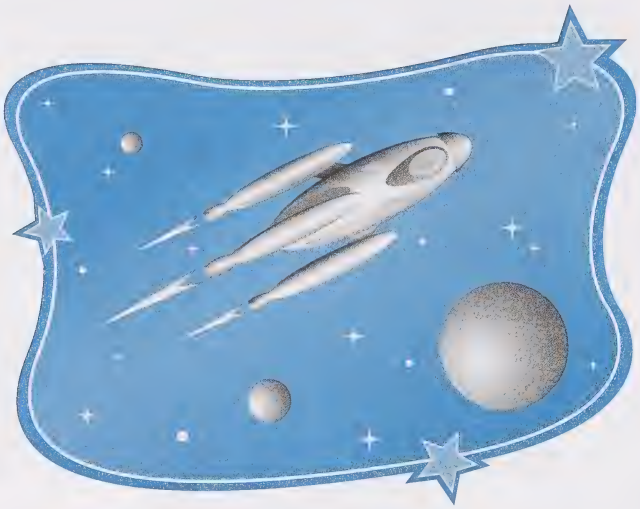
Some of the practical problems involving the multiplication and division of decimal numerals arise when forecasting the weather. Weather systems moving across the country are monitored by weather stations. The speed of storms and distances involved enter into forecaster's calculations used to predict what local conditions will be and when they will occur.

Turn to Assignment Booklet 2B and complete the Lesson 3 Assignment.

Keep Assignment Booklet 2B until you have completed the entire booklet.

Module Summary

In Module 2 you reviewed and extended your use of arithmetic operations. Strategies for estimation and computation with whole numbers were reinforced. Operations with decimals were extended to thousandths. You developed pencil-and-paper methods using base ten blocks, place-value charts, and counters. You used a variety of estimation and mental computation strategies, pencil-and-paper methods, and calculators to solve problems.



Calculations involving decimals are a part of everyday life whether you are at school or on the job. Today, calculators and computers easily perform complicated calculations. Can you imagine all the calculations involved in sending satellites into space or probes to the planets and their moons?

What do you think computer technology will be like in the future when manned space missions go to the far reaches of the solar system and beyond?

Turn to Assignment Booklet 2B and complete the Numbers in the News project.

When you are done, submit Assignment Booklet 2B to your teacher to be marked.

Keystrokes

Take out your calculator and complete the following exercises. They will help you review some of the ideas you have learned in Module 2.

Funky Feature: Broken Calculator

Imagine that the 7, 8, and 9 keys on your calculator are stuck, and you have some important calculations to make! Just think of each number as the sum of two numbers. As you study four examples, look for the pattern used to split the numbers.

Example

To add $7819 + 8546$, you could split 7819 into 6616 and 1203, and you could split 8546 into 6546 and 2000.

		7819				8546			
Keystrokes	ON/C	6616	+	1203	+	6546	+	2000	=
Display	0	6616	6616	1203	7819	6546	14365	2000	16365

Check: $7819 + 8546 = 16\,365$

Example

To subtract $9571 - 2894$, split 9571 into 6561 and 3010, and split 2894 into 2664 and 230.

		9571				2894			
Keystrokes	ON/C	6561	+	3010	−	2664	−	230	=
Display	0	6561	6561	3010	9571	2664	6907	230	6677

Check: $9571 - 2894 = 6677$

Example

To multiply 78×7239, split 78 into 66 and 12, and split 7239 into 6236 and 1003.

		78					2894				
Keystrokes	ON/C	66	+	12	M+	6236	+	1003	×	MRC	=
Display	0	66	66	12	78	6236	6236	1003	7239	78	564642

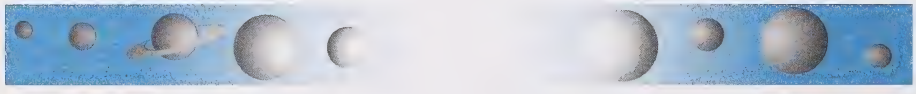
Check: $78 \times 7239 = 564\ 642$

Example

To divide $8769 \div 79 = 111$, split 79 into 66 and 13, and split 8769 into 6666 and 2103.

		79					8769				
Keystrokes	ON/C	66	+	13	M+	6666	+	2103	÷	MRC	=
Display	0	66	66	13	79	6666	6666	2103	8769	79	111

Check: $8769 \div 79 = 111$



1. Explain the pattern that was used in the examples to split numbers so that the 7, 8, and 9 keys were not needed.

Check your answers on page 146 in the Appendix.

Now, try questions 2 to 5 without using the 7, 8, and 9 keys. You may split the numbers by using the pattern from the examples, or you may try splitting them in other ways. When you check your answers, use your calculator as you normally would.

2. $19\,678 + 75\,819$ **3.** $67\,384 - 48\,993$

4. $97 \times 75\,387$ **5.** $80\,388 \div 87$

Check your answers on pages 146 and 147 in the Appendix.

Funky Feature: How Close Can You Get?

You can improve your estimation skills by using the constant multiplier on your calculator.

Example

Find the closest whole number factor.

$3.1 \times \square = 43$

Keystrokes	ON/C	3.1	×	15	=	14	=	13	=
Display	0	3.1	3.1	15	46.5	14	43.4	13	40.3

This shows that the missing factor is between 13 and 14, but closer to 14.

Don't clear your calculator! You need to keep using the constant multiplier. Now, find the closest factor to the nearest tenth.

Keystrokes	13.5	=	13.8	=	13.9	=
Display	13.5	41.85	13.8	42.78	13.9	43.09

This shows that the missing factor is between 13.8 and 13.9, but closer to 13.9.

Don't clear your calculator! Now, find the closest factor to the nearest thousandth.

Keystrokes	13.86	=	13.87	=	13.88	=
Display	13.86	42.966	13.87	42.997	13.88	43.028

This shows that the missing factor is between 13.87 and 13.88, but closer to 13.87.

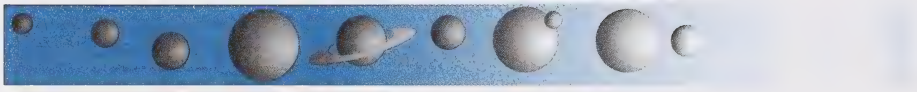
Don't clear your calculator! Now, find the closest factor to the nearest thousandth.

Keystrokes	13.871	=
Display	13.871	43.0001

This shows that the missing factor is between 13.87 and 13.871, but closer to 13.871.

Now, divide to check the work.

Keystrokes	ON/C	43	÷	3.1	=
Display	0	43	43	3.1	13.870967



For questions 6 and 7, find each answer to the nearest whole number, the nearest tenth, the nearest hundredth, and the nearest thousandth. Check your work by dividing.

6. $2.6 \times \quad = 71$

7. $4.2 \times \quad = 125$

Check your answers on pages 147 and 148 in the Appendix.

Review

The activities in this lesson will help you review and apply what you learned in Module 2 and prepare for the final test. Discuss with your home instructor when you should begin the Review and how much of the Review you should complete.

The following two tables provide data about Alberta's population.

TABLE 1: ALBERTA'S OFFICIAL POPULATION FROM 1960 TO 2000

Year	Population
1960	1 265 572
1961	1 302 279
1962	1 343 808
1963	1 370 240
1964	1 402 664
1965	1 425 543
1966	1 459 746
1967	1 457 924
1968	1 497 369
1969	1 537 850
1970	1 576 549
1971	1 619 305
1972	1 658 231
1973	1 664 366

Year	Population
1974	1 687 530
1975	1 758 260
1976	1 806 955
1977	1 868 427
1978	1 928 579
1979	2 010 591
1980	2 094 212
1981	2 181 374
1982	2 273 955
1983	2 293 144
1984	2 301 888
1985	2 318 408
1986	2 354 299
1987	2 368 634

Year	Population
1988	2 383 984
1989	2 415 756
1990	2 469 069
1991	2 510 001
1992	2 543 033
1993	2 574 890
1994	2 601 282
1995	2 615 873
1996	2 636 489
1997	2 695 474
1998	2 730 818
1999	2 819 423
2000	2 879 743

TABLE 2: ALBERTA'S POPULATION FOR 10-YEAR INTERVALS FROM 1901 TO 1951

Year	1901	1911	1921	1931	1941	1951
Population	73 000	374 000	589 000	732 000	796 000	940 000

Use the information in Table 1 to answer questions 1 to 5.

1. Estimate and then calculate the increase in population between the following years.

   a. 1960 and 2000
   b. 1960 and 1970
   c. 1970 and 1980
   d. 1980 and 1990
   e. 1990 and 2000

2. Use your answers from question 1 to predict Alberta's population in 2010. Explain.

3. **a.** Between which two consecutive years was there a decrease in Alberta's population?

   b. By how much did the population decrease?

4. **a.** In which year was the population of Alberta closest to being twice as great as it was in 1960? Explain.

   b. In which year was the population of Alberta closest to being half as great as it was in 2000? Explain.

Use the information in Table 1 and Table 2 to answer questions 5 and 6.

5. **a.** Estimate how many times greater the population of Alberta was in 2000 than in 1901?

   b. Estimate how many times greater the population of Alberta was in 1911 than in 1901?

6. **a.** Use estimation to decide in which year the population of Alberta was about one-fifth of the population in 2000. Explain.

   b. Use estimation to decide in which year the population of Alberta was about one-third of the population in 2000. Explain.

If you need help with questions 1 to 6, look back at Lesson 1, where you learned about operations with large numbers. If you feel you need more practice, do questions 7 to 11.

The following table gives information about the Great Lakes. Use this information to answer questions 7 to 11.

Lake	Length (km)	Maximum Depth (m)	Total Area (km^2)	Area on Canadian Side of Boundary (km^2)
Superior	563	406	82 100	28 700
Michigan	494	282	57 800	—
Huron	332	229	59 600	36 000
Erie	388	64	25 700	12 800
Ontario	311	244	18 960	10 000

7. Identify the longest lake and the shortest lake. Find the difference between their lengths.

8. Identify the lake with the greatest area and the lake with the least area.

a. Find the difference between their areas.

b. Estimate how many times larger in area the largest lake is than the smallest lake. Explain.

9. Identify the lakes that have the greatest maximum depth and the least maximum depth.

a. Find difference between their depths.

b. Estimate how many times deeper the one lake is than the other. Explain.

10. a. Which of the Great lakes has about one-half of its area in Canada? Explain.

b. Which of the Great lakes has about one-third of its area in Canada? Explain.

11. a. Estimate and then calculate the total area of the five Great Lakes.

b. Is most of the total area of the Great Lakes in Canada or the United States? Explain.

Check your answers on pages 149 to 152 in the Appendix.

12. Show your work and explain your strategy for solving these problems.

a. Wilma bought 2 bags of apples. The difference between the masses of the 2 bags was 3.168 kg. What might have been the mass of each bag?

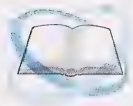
b. Quinton paid $152.75 for 4 pairs of pants. Each pair was a different price. What could each pair of pants have cost?

13. a. Using the same numbers, rewrite this addition sentence to give two subtraction sentences.

$$\$173.82 + \$71.50 = \$245.32$$

b. Using the same numbers, rewrite this subtraction sentence to give a different subtraction sentence and an addition sentence.

$$45.813\ \text{L} - 12.156\ \text{L} = 33.657\ \text{L}$$



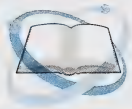
14. Turn to page 60 of your textbook. Use the information in Nature Wear at the bottom of the page to answer the following questions.

a. Estimate the total cost to buy one of each of the four articles of clothing. Explain.

b. Use mental computation to find the total cost of the four articles of clothing. Explain.

c. Edwin wants to buy just three of the four articles of clothing. List all possible combinations, and use mental computation to find the cost of each. Explain.

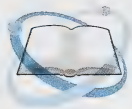
If you need help with questions 12 to 14, look back at Lesson 2, where you learned about adding and subtracting decimals. If you feel you need more practice, do questions 15 and 16.



15. Turn to page 76 of your textbook. Do questions 1 to 6 of Practise Your Skills.

16. Turn to page 96 of your textbook. Do question 6 of Skill Bank from This Unit.

Check your answers on pages 153 and 154 in the Appendix.



17. Turn to page 78 of your textbook to On Your Own. Do question 3, using the statistic that life expectancy in Canada is about 75 years for males and about 81 years for females. Give an estimate for each type of food, and then answer the question by using your calculator.

18. Turn to page 77 of your textbook to Exploring Multiplication and Division. Use the information given to answer the following questions. Show your work.

a. Suppose the average person eats the same amount of hamburger buns as hot dog buns. Estimate and then calculate the number of hamburger buns each person would eat per year.

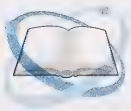
b. Suppose each person ate a 0.11-kg hamburger patty with each hamburger bun. Estimate and then calculate the number of kilograms of hamburger meat each person would eat per year.

c. Suppose equal amounts of ketchup, mayonnaise, and mustard are put on a hamburger. Estimate and then calculate the number of litres of ketchup each person would put on hamburgers per year.

d. Estimate and then calculate the number of kilograms of cheese each person would put on hamburgers per year.

If you need help with questions 10 and 11, look back at Lesson 3, where you learned about multiplying and dividing decimals. If you feel you need more practice, do questions 19 to 21.

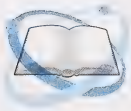
19. Turn to page 81 of your textbook. Do questions 1 to 8 of Practise Your Skills.



20. Turn to page 83 of your textbook. Do questions 1 to 6 of Practise Your Skills.

21. Turn to page 96 of your textbook. Do question 7 of Skill Bank from This Unit.

Check your answers on pages 155 to 158 in the Appendix.



22. Turn to pages 92 to 94 of your textbook. Do questions 4.b., 4.c., 10, 11, 12, and 13 of Problem Bank.

Check your answers on pages 158 to 160 in the Appendix.

If you still feel you need more practice, do the following pages in the Practice and Homework Book:

- Lesson 1: pages 131 to 151
- Lesson 2: pages 26 to 29, pages 152 to 159
- Lesson 3: pages 30 to 37, pages 160 to 167

If you need additional work to master the material in this module, work through Lesson 5: Solving Problems with Decimals on the Mathematics 6 Companion CD.

After completing this lesson, you can print an assignment by clicking on the Activity button at the bottom of the page.

Ask your home instructor to print the solutions to the questions in the activity by clicking on the Parent Notes button at the bottom of the page. Discuss your answers with your home instructor.

Just the Facts

Ask your home instructor to time you as you complete the following timed drill. Your goal is to complete all 25 questions in two minutes. At the end of two minutes, count how many questions you were able to complete. Then use the Answer Key in the Appendix to mark the drill, and record your score in the space provided. Before you move on, go back and complete any questions you did not finish.

Multiplication and Division Facts

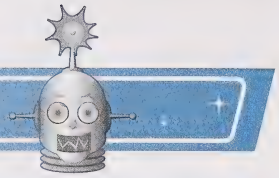
$1 \times 9 =$	$24 \div 8 =$	$\begin{array}{r} 5 \\ \times\ 2 \\ \hline \end{array}$	$4\overline{)16}$	$5 \times 0 =$
$15 \div 3 =$	$\begin{array}{r} 1 \\ \times\ 0 \\ \hline \end{array}$	$2\overline{)4}$	$5 \times 4 =$	$36 \div 6 =$
$\begin{array}{r} 4 \\ \times\ 6 \\ \hline \end{array}$	$4\overline{)28}$	$4 \times 6 =$	$18 \div 2 =$	$\begin{array}{r} 8 \\ \times\ 9 \\ \hline \end{array}$
$8\overline{)64}$	$8 \times 2 =$	$30 \div 6 =$	$\begin{array}{r} 2 \\ \times\ 3 \\ \hline \end{array}$	$1\overline{)1}$
$2 \times 8 =$	$81 \div 9 =$	$\begin{array}{r} 6 \\ \times\ 7 \\ \hline \end{array}$	$2\overline{)0}$	$1 \times 0 =$

Multiplication and Division Facts

Number completed in 2 minutes: _____
Number correct in 2 minutes: _____

Record your score on the Just the Facts Progress Chart.

Mental Math



What happens if you cut something in half and then double the result? You end up where you started, of course! Here's a way you can use this inverse relationship between multiplication and division to do mental math.

Halving and Doubling

You know that it is easy to mentally multiply or divide by 10, 100, 1000, and so on. If you can change one of the factors you are multiplying to such a number, then it will be easy to get the answer mentally.

Example

To multiply 5×48, double 5 and halve 48.

$$10 \times 24 = 240$$

Example

Try 25×54.

Double 25 and halve 54.

$$50 \times 27$$

Double 50 and halve 27.

$$100 \times 13.5 = 135$$

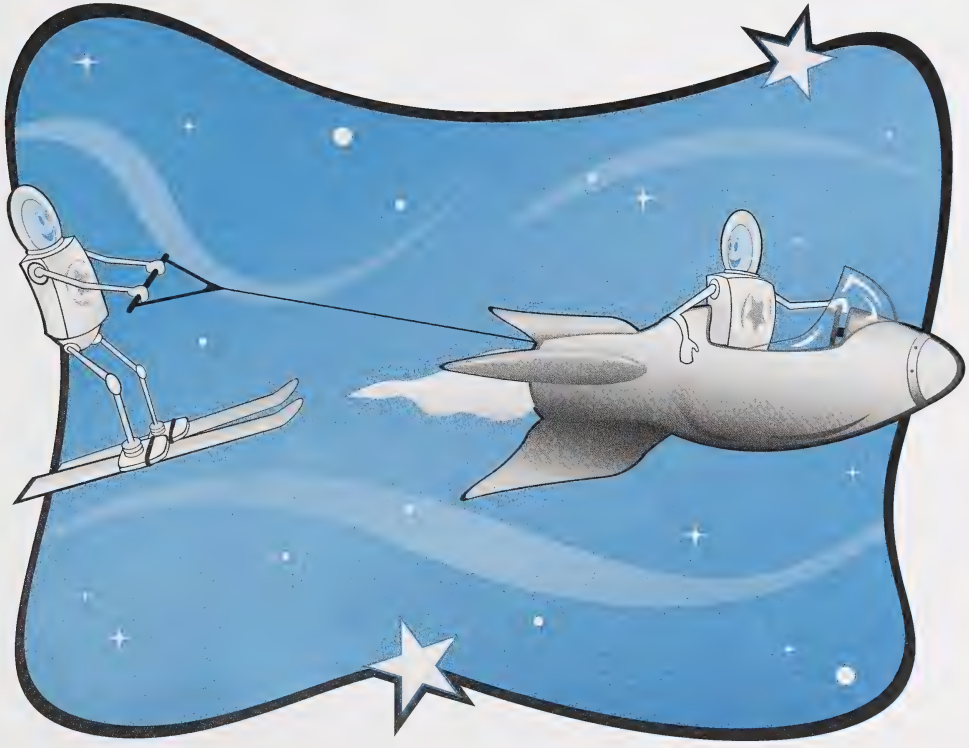
The trick is to know what numbers you can repeatedly double to get 10, 100, 1000, ...

Use halving to find out! Begin with 10 or 100 or 1000, and repeatedly halve them.

10 → 5 → 2.5 → 1.25
100 → 50 → 25 → 12.5 → 6.25
1000 → 500 → 250 → 125 → 62.5 → 31.25

Do you see a pattern here? Using the pattern will help you to remember which numbers work well with this strategy. This strategy may seem somewhat limited, but you often need to multiply by some of these numbers, especially when money is involved.

Try to practise these strategies whenever it is appropriate to use them.

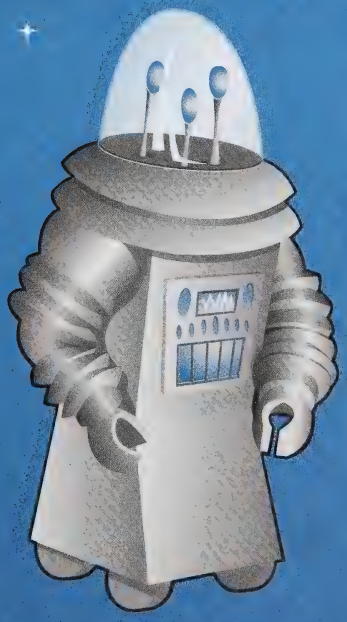


Mathematics 6

Appendix

Glossary

Answer Key



Glossary

mass: a measure of the quantity of matter in an object

mean: the average of a set of numbers found by adding the numbers in the set and then dividing this sum by the number of numbers in the set

weight: a measure of the force of gravity on an object

Answer Key

Lesson 1: Computing with Whole Numbers

Activity 1

Estimation and mental-computation strategies will vary. Sample answers are given.

1. a. Tito's trip lasted about 8 days. From Saturday morning to the following Saturday morning is one week (7 days), and to Sunday morning is 1 more day.

b. Tito's trip lasted 7 d, 21 h, and 58 min. From 03:37 on April 28 to 03:37 on May 6 is exactly 8 days. However, 01:35 is 2 h and 2 min before 03:37, so Tito's trip is 2 h and 2 min short of being 8 full days. To find how much longer than 7 days the trip was, subtract 2 h and 2 min from 24 h.

$$24\text{ h} - 2\text{ h} = 22\text{ h}$$
$$22\text{ h} - 2\text{ min} = 21\text{ h }58\text{ min}$$

c. To the nearest hour, Tito's trip lasted 7 days and 22 hours. (21 h and 58 min is almost 22 h.)

d. To the nearest day, Tito's trip lasted 8 days. (22 h is almost 1 day.)

2. Dennis Tito made his historic flight 40 years after Gargarin. Skip count by 10 years, beginning at 1961.

3. Dennis Tito's trip cost $2.5 million per day.

$$\$20 \text{ million} \div 8 = \$2.5 \text{ million}$$

4. Dennis Tito could have paid for 500 trips with this amount. To divide $10 billion by $20 million, think of a billion as 1000 million.

$$\begin{aligned}\$10 \text{ billion} \div \$20 \text{ million} &= 10\,000 \text{ million} \div 20 \text{ million} \\ &= 1000 \div 2 \\ &= 500\end{aligned}$$

5. a. Estimate: You would have to save about $400 000 every year. If you are 11 years old, in about 50 years you will be 60 years old.

$$\$20\,000\,000 \div 50 = \$400\,000$$

Calculation: You would have to save $408 163.26 every year for 49 years $(60 - 11 = 49)$.

$$\$20\,000\,000 \div 49 \doteq \$408\,163.26$$

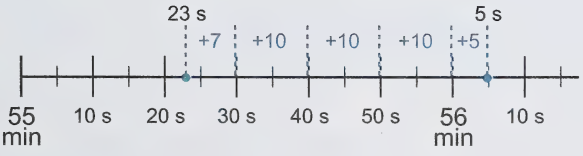
b. Estimate: I would have to save about $40 000/month. Rounding 1 year to 10 months, $\$400\,000 \div 10 = \$40\,000$/month.

Calculation: You would have to save $34 013.61/month.

$$\$408\,163.26 \div 12 \doteq \$34\,013.61$$

6. One Space Shuttle mission costs $500 million.

7. Grissom's flight lasted 9 s longer than Shepard's flight (37 s − 28 s = 9 s). Carpenter's flight lasted 42 s longer than Glenn's flight. Begin at 55 min and 23 s, and count on.



8. a. Estimate: The 1961 total was about 30 min (15 min + 15 min).

Calculation: The 1961 total was 31 min and 5 sec.

	15 min	28 s
+	15 min	37 s
	30 min	65 s
=	31 min	05 s

b. Estimate: The 1962 total was about 19 h. Each time is rounded to the nearest hour.

5 h + 5 h + 9 h = 19 h

Calculation: The 1962 total was 19 h, 4 min, and 39 s.

	04 h	55 min	23 s
	04 h	56 min	05 s
+	09 h	13 min	11 s
	17 h	124 min	39 s
=	19 h	04 min	39 s

c. Estimate: The May total was about 1 d and 15 h. Round the times to the nearest hour.

0 h + 5 h + 1 d 10 h = 1 d 15 h

Calculation: The May total was 1 d, 15 h, 31 min, and 22 s.

Shepard			15 min	28 s
Carpenter		04 h	56 min	05 s
Cooper	1 d	10 h	19 min	49 s
	1 d	14 h	90 min	82 s
=	1 d	14 h	91 min	22 s
=	1 d	15 h	31 min	22 s

d. Estimate: The entire Mercury program total was about 2 d, 5 h, and 55 min. Round each time to the nearest hour.

$$0\text{ h} + 19\text{ h} + 1\text{ d } 10\text{ h} = 1\text{ d } 29\text{ h}$$
$$= 2\text{ d } 5\text{ h}$$

Calculation: The entire Mercury program total was 2 d, 5 h, 55 min, and 33 s. Add the answers from questions 8.a. and 8.b. with Cooper's time.

Question 8.a.			31 min	05 s
Question 8.b.		19 h	04 min	39 s
Cooper	1 d	10 h	19 min	49 s
	1 d	29 h	54 min	93 s
	= 2 d	05 h	55 min	33 s

9. a. Estimate: The total distance of the 1961 missions was about 1000 km.

$$500\text{ km} + 500\text{ km} = 1000\text{ km}$$

Calculation: The total distance of the 1961 missions was 974 km.

$$\begin{array}{r} 488\text{ km} \\ +\ 486\text{ km} \\ \hline 974\text{ km} \end{array}$$

b. Estimate: The total distance of the 1962 missions was about 400 000 km.

$$100\,000\text{ km} + 100\,000\text{ km} + 200\,000\text{ km} = 400\,000\text{ km}$$

Calculation: The total distance of the 1962 missions was 476 050 km.

$$\begin{array}{r} 121\,843\text{ km} \\ 122\,394\text{ km} \\ +\ 231\,813\text{ km} \\ \hline 476\,050\text{ km} \end{array}$$

10. Estimate: The distance Cooper travelled was about 500 000 km greater than the sum of the distances for all other missions in the Mercury program. Cooper travelled about 900 000 km. The sum of the other distances is about

$0 \text{ km} + 0 \text{ km} + 100\,000 \text{ km} + 100\,000 \text{ km} + 200\,000 \text{ km} = 400\,000 \text{ km}$.

$900\,000 \text{ km} - 400\,000 \text{ km} = 500\,000 \text{ km}$

Calculation: The distance Cooper travelled was 402 305 km greater than the sum of the distances for all other missions in the Mercury program. Add the answers from questions 9.a. and 9.b., and subtract that sum from Cooper's distance.

$$\begin{array}{r} 974 \text{ km} \\ +\ 476\,050 \text{ km} \\ \hline 477\,024 \text{ km} \end{array} \qquad \begin{array}{r} 879\,329 \text{ km} \\ -\ 477\,024 \text{ km} \\ \hline 402\,305 \text{ km} \end{array}$$

11. The velocity of Cooper's mission was almost the same as the velocity of each of the 1962 missions. To find the differences, you just need to subtract the tens and ones digits.

- Cooper's velocity was 5 km/h faster than Glenn's velocity $(51 - 46)$.
- Cooper's velocity was 3 km/h slower than Carpenter's velocity $(54 - 51)$.
- Cooper's velocity was 17 km/h slower than Schirra's velocity $(68 - 51)$.

Activity 2

1. a. The greatest predicted yearly cost is \$10 billion/year (\$100 billion ÷ 10 years).

b. The least predicted yearly cost is \$2.4 billion/year. To calculate mentally, you want to be able to divide by 100 instead of by 25. \$60 billion for 25 years would be like \$240 billion for 100 years (4 times as much).

$\$240 \text{ billion} \div 100 \text{ years} = \$2.4 \text{ billion/year}$

2. **Estimate:** The estimated projected total cost per country ranges between $4 billion and $7 billion.

   To get $4 billion, think the following:

   - $\$60 \text{ billion} \div 16$ is about the same as $\$60 \text{ billion} \div 15$.
   - Since $4 \times 15 = 60$, the estimate is $4 billion.

   To get $7 billion, think the following:

   - $\$100 \text{ billion} \div 16$ is between $\$100 \text{ billion} \div 10$ and $\$100 \text{ billion} \div 20$ because 16 is between 10 and 20, but it is closer to 20.
   - $\$100 \text{ billion} \div 10 = \$10 \text{ billion}$, and $\$100 \text{ billion} \div 20 = \$5 \text{ billion}$. $7 billion is between $5 billion and $10 billion, but it is closer to $5 billion.

   Calculation: The projected total cost per country will range between $3 750 000 000 and $6 250 000 000.

   - $60 \div 16 = 3.75$, so $\$60 \text{ billion} \div 16 = \$3.75 \text{ billion}$ (close to the estimate of $4 billion).
   - $100 \div 16 = 6.25$, so $\$100 \text{ billion} \div 16 = \$6.25 \text{ billion}$ (close to the estimate of $7 billion).

3. **a.** The moon is about 1000 times farther from Earth than the ISS is. 384 000 is about 400 000 and $1000 \times 400 = 400\,000$.

   b. Using your calculator, the moon is 960 times farther from Earth than the ISS is.

   $$384\,000 \text{ km} \div 400 \text{ km} = 960$$

   c. The distance from Earth to the ISS is $\frac{1}{1000}$ of the distance from Earth to the moon.

4. a. The ISS orbits Earth at a speed that is about 7 times faster than the moon's orbital speed.

Estimate: 3680 km/h is about 4000 km/h.

$7 \times 4000 \text{ km/h} = 28\,000 \text{ km/h}$ (which is about the speed of the ISS)

Calculation: $27\,650 \text{ km/h} \div 3680 \text{ km/h} \doteq 7.513\,586\,9$ $\left(\text{about } 7\frac{1}{2} \text{ times faster}\right)$

b. Estimate: The ISS travels about 45 000 km in one complete orbit.

- 27 650 km/h is about 30 000 km in 1 h and 15 000 km in 0.5 h.
- $90 \text{ min} = 1 \text{ h} + 0.5 \text{ h}$, and $30\,000 \text{ km} + 15\,000 \text{ km} = 45\,000 \text{ km}$.

Calculation: The ISS travels 41 475 km in one complete orbit.

- Convert time: $90 \text{ min} = 1 \text{ h} + 0.5 \text{ h}$
- $1.5 \text{ h} \times 27\,650 \text{ km/h} = 41\,475 \text{ km}$

c. The moon travels about 60 times farther than the ISS does in one complete orbit.

- ISS: 41 475 km is about 40 000 km.
- $60 \times 40\,000 \text{ km} = 2\,400\,000 \text{ km}$ (the orbital distance of the moon)

5. The Canadarm2 is about 4.5 times longer than the smaller arm.

Mental Computation

$4 \times 4 \text{ m} = 16 \text{ m}$ and $5 \times 4 \text{ m} = 20 \text{ m}$. 18 is exactly halfway between 16 and 20, and 4.5 is exactly halfway between 4 and 5.

Pencil-and-Paper Method

$$\begin{array}{r} 4.5 \\ 4\overline{)18.0} \\ \underline{16} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

6. a. Mir had a mass of about 100 000 kg.

410 000 kg is about 400 000 kg

$400\ 000\ \text{kg} \div 4 = 100\ 000\ \text{kg}$

b. The approximate mass of *Endeavor* is 90 000 kg.

$500\ \text{t} = 500\ 000\ \text{kg}$

$500\ 000\ \text{kg} - 410\ 000\ \text{kg} = 90\ 000\ \text{kg}$

7. a. Estimate: The *Atlas's* thrust was about 4 or 5 times greater than the *Redstone's* thrust.

- 163 962 kg is about 160 000 kg, and 35 381 kg is about 40 000 kg.
- $160\ 000\ \text{kg} \div 40\ 000\ \text{kg} = 16\ \text{kg} \div 4\ \text{kg}$
  $= 4$

or

- 163 962 kg is about 200 000 kg, and 35 381 kg is about 40 000 kg.
- $200\ 000\ \text{kg} \div 40\ 000\ \text{kg} = 20\ \text{kg} \div 4\ \text{kg}$
  $= 5$

Calculation: The *Atlas's* thrust was almost 5 times greater than the *Redstone's* thrust.

$163\ 962\ \text{kg} \div 35\ 381\ \text{kg} \doteq 4.634\ 182\ 1$

b. Estimate: The space shuttle's thrust was about 100 times greater than the *Redstone's*.

- 3.3 million kilograms is about 3 000 000 kg, and 35 381 kg is about 30 000 kg.
- $3\ 000\ 000\ \text{kg} \div 30\ 000\ \text{kg} = 100$

or

- 35 381 kg is about 33 000 kg.
- $33\ 000\ \text{kg} \times 100 = 3\ 300\ 000\ \text{kg}$ (the thrust of the space shuttle)

Calculation: The space shuttle's thrust was about 93 times greater than the *Redstone's*.

$$3\ 300\ 000\ \text{kg} \div 35\ 381\ \text{kg} \doteq 93.270\ 399$$

c. Estimate: The space shuttle's thrust was about 20 times greater than the *Atlas's*.

- 3.3 million kilograms is about 3 000 000 kg, and 163 926 kg is about 150 000 kg.
- $3\ 000\ 000\ \text{kg} \div 150\ 000\ \text{kg} = 300\ \text{kg} \div 15\ \text{kg}$
  $= 20$

You could also use answers from questions 7.a. and 7.b.

- Recall that *Atlas's* thrust was 5 times greater than *Redstone's*, but the space shuttle's thrust is 100 times greater than *Redstone's*.
- To compare the space shuttle with *Atlas*, divide.

  $100 \div 5 = 20$

Calculation: The space shuttle's thrust was about 20 times greater than the *Atlas's*.

$$3\ 300\ 000\ \text{kg} \div 163\ 926\ \text{kg} \doteq 20.131\ 034$$

8. In Module 1 you learned that $1°\text{K}$ is the same size as $1°\text{C}$. The two scales just have $0°$ at a different place (temperature). The difference between $20°\text{K}$ and $3589°\text{K}$ is $3569°\text{K}$.

$$3589° - 20° = 3569°$$

The difference between $-253°\text{C}$ and $3316°\text{C}$ is $3569°\text{C}$.

- From $-253°\text{C}$ to $0°\text{C}$ is $253°$, and from $0°\text{C}$ to $3316°\text{C}$ is $3569°\text{C}$.

  $$253° + 3316° = 3569°$$

9. The difference between the temperatures is 3317°C.

Mental computation: 3371°C – 51° = 3320°; 3320°C – 3° = 3317°

or

Count on using just the tens and ones digits.

- 54 + 6 = 60; 60 + 11 = 71,
- 6 + 11 = 17, which makes the difference 3317°

Pencil-and-Paper Method

$$\begin{array}{r} {\scriptstyle 6\ 11} \\ 33\not{7}\not{1} \\ -\ \ 5\ 4 \\ \hline 33\ 1\ 7 \end{array}$$

Activity 3

1. The difference between the length of the primary highways and the length of the secondary highways is 1235 km.

   Estimate: 15 000 km – 14 000 km = 1000 km

   Calculation: 15 060 km – 13 825 km = 1235 km

2. The total length of the primary highways, the secondary highways, and the municipal roads is 159 029 km.

   Estimate (in thousands): 14 000 + 15 000 + 130 000 = 159 000 km

   Calculation: 13 825 + 15 160 + 130 144 = 159 029

3. The total length of the remaining roads in the province is 27 121 km.

   Estimate (in thousands): 190 – 160 = 30 (thousand kilometres)

   Calculation: 186 150 – 159 029 = 27 121 km

4. The length of municipal roads is about 4.5 times greater than the combined length of the primary and secondary highways.

   Estimate: Combined length of primary and secondary highways $= 2 \times 15$ thousand
   $= 30$ thousand

   Round the municipal roads to 120 000 because 12 is a multiple of 3.

   $120\,000 \div 30\,000 = 4$ times

   Calculation: Combined length of primary and secondary highways $= 13\,825 + 15\,060$
   $= 28\,885$

   Municipal $\div$ Combined $= 130\,144 \div 28\,885$
   $\doteq 4.505\,591\,1$ times greater

5. The total length of provincial roadways covers the distance from the northern border to the southern border about 152 times.

   Estimate: $180\,000 \div 1000 = 180$ times greater
   Calculation: $186\,150 \div 1223 \doteq 152.207\,68$

6. **a.** The north-south distance is nearly 4.2 times greater than the least west-east distance.

   Estimate: $1200 \div 300 = 4$ times greater
   Calculation: $1223 \div 293 \doteq 4.174\,061\,4$

   b. The north-south distance is nearly 1.9 times greater than the greatest west-east distance.

   Estimate: $1200 \div 600 = 2$ times greater
   Calculation: $1223 \div 660 \doteq 1.853\,030\,3$

7. The total area of national parks in Alberta is $49\ 315\ km^2$.

   Estimate (in thousands): $7 + 0 + 11 + 1 + 31 = 50$ thousand km^2

   Calculation: $6641 + 194 + 10\ 878 + 526 + 31\ 080 = 49\ 319\ km^2$

8. The area of the largest park is about 161 times greater than the area of the smallest park.

   Estimate: $30\ 000 \div 200 = 150$ times larger

   Calculation: $31\ 080 \div 193 \doteq 161.036\ 26$ times larger

9. The total spent by all tourists is about twice the total spent by all tourists outside Alberta.

   Estimate:

   Total spent by all (in millions): $2000 + 800 + 600 + 600 = 4000$ million
   $= \$4$ billion

   Total spent by all from outside Alberta (in millions): $800 + 600 + 600 = 2000$ million
   $= \$2$ billion

   $\$4$ billion $\div \$2$ billion $= 2$ times greater

   Calculation: $806 + 632 + 565 = 2003$
   $2003 + 2100 = 4103$
   $4103 \div 2003 \doteq 2.048\ 427\ 3$

Challenge Activity

There were 6050 pearls in the shipment.

Solution strategies will vary. Two sample strategies are given.

Method 1

The total number of pearls must be a multiple of 110. By entering 110 as a constant addend on your calculator, you can find multiples of 110 that end in 50, and then check to see which of these multiples works.

Keystrokes	ON/C	110	+	=	=	=	=
Display	0	110	110	220	330	440	550

=	=	=	=	=	=	=	=	=	=
...	1650	...	2750	...	3850	...	4950	...	6050

Number of Pearls	**Pearls on Each of 100 Necklaces**	**Pearls on Each of 110 Necklaces**	**Does this make 110 Necklaces?**
550	$500 \div 100 = 5$	$5 - 5 = 0$	No
1650	$1600 \div 100 = 16$	$16 - 5 = 11$	$1650 \div 11 = 150$ (No)
2750	$2700 \div 100 = 27$	$27 - 5 = 22$	$2750 \div 22 = 125$ (No)
3850	$3800 \div 100 = 38$	$38 - 5 = 33$	$3850 \div 33 = 116$ R22 (No)
4950	$4900 \div 100 = 49$	$49 - 5 = 44$	$4950 \div 44 = 112$ R22 (No)
6050	$6000 \div 100 = 60$	$60 - 5 = 55$	$6050 \div 55 = 110$ (Yes!)

Method 2

Number of Pearls on Each Necklace	Number of Necklaces	Pearls Used	Pearls Left Over	Total Number of Pearls	
10	100	$10 \times 100 = 1000$	50	1050	> Not the same
5	110	$5 \times 110 = 550$	0	550	
20	100	$20 \times 100 = 2000$	50	2050	> Not the same
15	110	$15 \times 110 = 1650$	0	1650	
30	100	$30 \times 100 = 3000$	50	3050	> Not the same
25	110	$25 \times 110 = 2750$	0	2750	
40	100	$40 \times 100 = 4000$	50	4050	> Not the same
35	110	$35 \times 110 = 3850$	0	3850	
50	100	$50 \times 100 = 5000$	50	5050	> Not the same
45	110	$45 \times 110 = 4950$	0	4950	
60	100	$60 \times 100 = 6000$	50	6050	> The same!
55	110	$55 \times 110 = 6050$	0	6050	

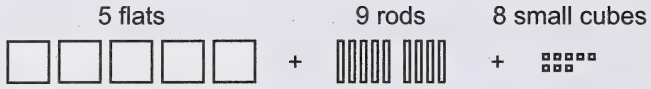
Lesson 2: Adding and Subtracting Decimals

Activity 1

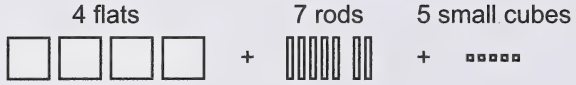
1. a. The total amount of food $= 0.598 \text{ kg} + 0.475 \text{ kg} + 0.617 \text{ kg}$

b. The large cube represents 1 kg. Each flat represents one-tenth of a kilogram (0.1 kg), each rod represents one-hundredth of a kilogram (0.01 kg), and each small cube represents one-thousandth of a kilogram (0.001 kg).

c. 0.598 kg



0.475 kg

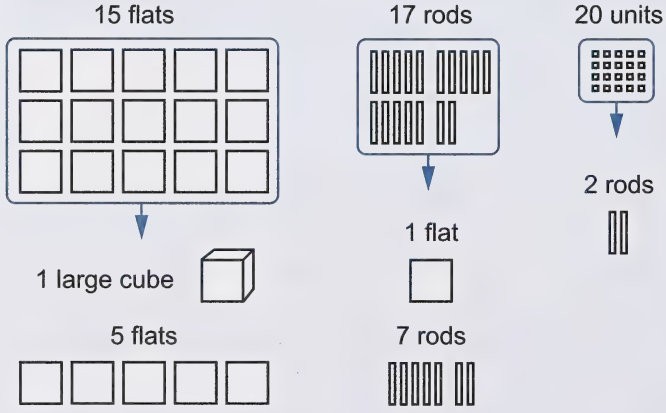


0.617 kg

d. Answers will vary. Sample answers are given.

Method 1

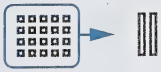
- Put all the flats together, all the rods together, and all the small cubes together, and then regroup each set.



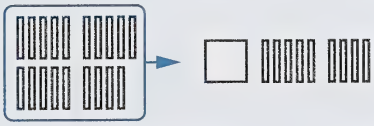
- Put all the flats together and all the rods together.
- You have 1 large cube, 6 flats, and 9 rods.

Method 2

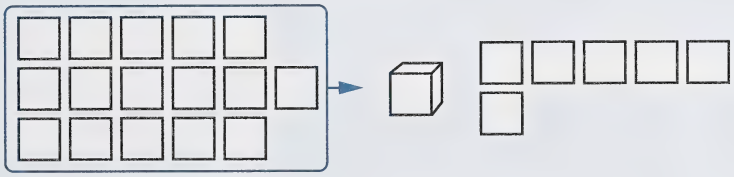
- Put all 20 small cubes together and regroup them to get 2 rods.



- Put all 19 rods together and regroup them to get 1 flat and 9 rods.



- Put all 16 flats together and regroup them to get 1 large cube and 6 flats.



- These are the regrouped blocks: 1 large block, 6 flats, and 9 rods.

e. The regrouped blocks represent 1.69 kg.

f. You can add 1 rod (0.01 kg) or 10 small cubes (0.001 kg) to your previous answer in order to reach 1.7 kg (or 1.700 kg).

2. a.

Large Cubes	Flats	Rods	Small Cubes
			

b. Using base ten blocks is the same as using a place-value chart and counters because you use the same number of blocks as counters to represent each place value. It is different because the base ten blocks are different sizes. The blocks used to represent a particular place value are one-tenth of the size of the blocks used to represent the place value to its left. The counters used on a place-value chart are all the same size. You can only tell their value by where they are on the place-value chart.

c.

Ones	Tenths	Hundredths	Thousandths
●	●	●	●●●●● ← Starting chips
	●●●●●	●●●●●●●	●●●●●● ← Adding chips

d.

Ones	Tenths	Hundredths	Thousandths
●	●●●●●	●●●●●	●
	●	●●●●	

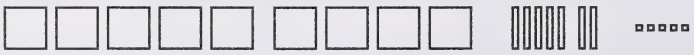
Regrouped chips

e. Cale ate 1.691 kg of food on his first day at the station.

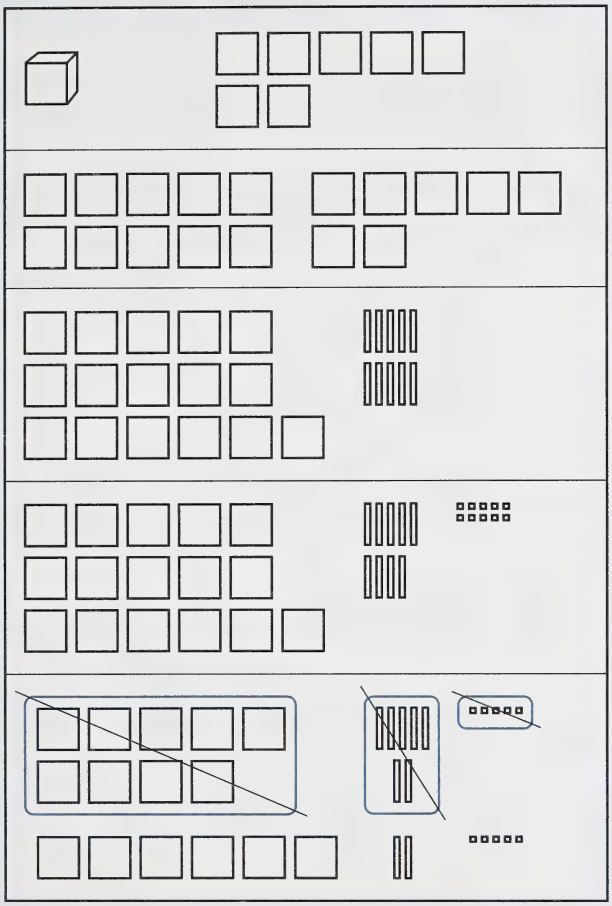
f. Add 9 counters to the Thousandths column to get 10 counters in that column. Ten thousandths equals 1 hundredth, so remove the 10 counters from the Thousandths column and replace them with 1 counter in the Hundredths column. Now there are 10 counters in the Hundredths column. Ten hundredths equals 1 tenth, so remove the 10 counters from the Hundredths column and replace them with 1 counter in the Tenths column. Now there are 7 counters in the Tenths column and 1 counter in the Ones column. This represents 1.7 kg.

Cale would have to eat 0.009 kg of food to reach his daily limit.

3. a. 1.7 = 

b. 0.975 = 

c.



1.7 kg

Trade the large cube for 10 flats.

Trade a flat for 10 rods.

Trade a rod for 10 units.

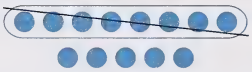
Circle the blocks that need to be removed.

d. Astronaut Jessie could eat up to 0.725 kg of food for her third meal of the day.

4. a.

Ones	Tenths	Hundredths	Thousandths
	●●●●●	●●●●	●●●

b. Trade 1 counter in the Tenths column for 10 counters in the Hundredths column, and then trade 1 counter in the Hundredths column for 10 counters in the Thousandths column. Remove 4 counters from the Tenths column, 8 counters from the Hundredths column, and 7 counters from the Thousandths column.

Ones	Tenths	Hundredths	Thousandths
			

c. Astronaut Remi ate 0.056 kg more food than Astronaut Erin ate.

5. a. All the tenths were grouped together to make 9 tenths. All the hundredths were grouped together to make 14 hundredths. All the thousandths were grouped together to make 15 thousandths.

b. The 14 hundredths were regrouped to make 1 tenth and 4 hundredths. This made a total of 10 tenths.

c. The 15 thousandths were regrouped to make 1 hundredth and 5 thousandths. This made a total of 5 hundredths.

d. Astronaut Chandler ate a total of 1.055 kg for breakfast and lunch.

6. a. All the thousandths were grouped together to make 15 thousandths. These were then regrouped to make 1 hundredth and 5 thousandths.

b. All the hundredths were grouped together to make 15 hundredths. These were then regrouped to make 1 tenth and 5 hundredths.

c. All the tenths were grouped together to make 10 tenths. These were then regrouped to make 1 one. Astronaut Chandler ate a total of 1.055 kg for breakfast and lunch.

7. Answers will vary. A sample answer is given.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					→ is	1	0	5	5
					→ is		6	4	5
					→ is				10
a.					→ is			1	0
					→ is			10	
b.					→ is		1	0	
					→ is		7		
c.					→ is	1	7		

a. All the thousandths were grouped together to make 10 thousandths. These were then regrouped to make 1 hundredth.

b. All the hundredths were grouped together to make 10 hundredths. These were then regrouped to make 1 tenth.

c. The tenths were grouped to make 7 tenths.

Astronaut Chandler ate a total of 1.7 kg of food that day.

8. a. One tenth was traded for 10 hundredths.

b. One hundredth was traded for 10 thousandths.

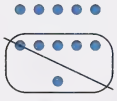
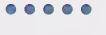
c. Five tenths were to be removed, 7 hundredths were to be removed, and 2 thousandths were to be removed.

d. That left 1 one, 1 tenth, 2 hundredths, and 8 thousandths.

Astronaut Kaeli can eat a total of 1.128 kg for her remaining meals.

9. a. Five tenths were to be removed.
b. This left 1 one and 2 tenths.
c. One tenth was traded for 10 hundredths.
d. Seven hundredths were to be removed.
e. This left 1 one, 1 tenth, and 3 hundredths.
f. One hundredth was traded for 10 thousandths.
g. Two thousandths were to be removed.
h. That left 1 one, 1 tenth, 2 hundredths, and 8 thousandths. This represents 1.128 kg.

10. Answers will vary. A sample answer is given.

	Ones	Tenths	Hundredths	Thousandths		Ones	Tenths	Hundredths	Thousandths
					→ is	1	1	2	8
a.					→ is	0	11	2	8
b.					→ is	0	11 −6	2	8
c.					→ is	0	5	2 −1	8
d.					→ is	0	5	1	8
e.					→ is	0	5	1	8 −3
f.					→ is	0	5	1	5

Explanation

a. One 1 was traded for 10 tenths.

b. Six tenths were to be removed.

c. This left 5 tenths, 2 hundredths, and 8 thousandths. One hundredth was to be removed.

d. This left 5 tenths, 1 hundredth, and 8 thousandths.

e. Three thousandths were to be removed.

f. This left 5 tenths, 1 hundredth, and 5 thousandths.

Kaeli could eat 0.515 kg of food for her supper on the same day.

11. Adding and subtracting decimals is the same as adding and subtracting whole numbers because you must combine numbers that have the same place value or remove numbers from those that have the same place value. The regrouping is done the same way. When you have 10 in any place value, it is traded for 1 in the place value to its left; and 1 in any place value is traded for 10 in the place value to its right.

12. a.
$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ \ \ } \\ 3.625 \\ +\ 8.918 \\ \hline 12.543 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ } \\ 6.123 \\ +\ 4.387 \\ \hline 10.510 \end{array}$$

c.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ } \\ 5.198 \\ +\ 2.143 \\ \hline 7.341 \end{array}$$

d.
$$\begin{array}{r} {\scriptstyle 5\ 11\ 1\ 13} \\ \cancel{6}.\cancel{1}\cancel{2}\cancel{3} \\ -\ 4.614 \\ \hline 1.509 \end{array}$$

e.
$$\begin{array}{r} {\scriptstyle 4\ 17\ \ } \\ 3.1\cancel{5}\cancel{7} \\ -\ 1.029 \\ \hline 2.128 \end{array}$$

f.
$$\begin{array}{r} {\scriptstyle 1\ 15\ 9\ 10} \\ \cancel{2}.\cancel{6}\cancel{0}\cancel{0} \\ -\ 1.921 \\ \hline 0.679 \end{array}$$

Activity 2

1. a. Steve's total purchase was less than 2 kg.

- 0.412 kg is less than 0.5 kg, and 1.259 kg is less than 1.5 kg.
- Since $0.5\text{ kg} + 1.5\text{ kg} = 2\text{ kg}$, $0.412\text{ kg} + 1.259\text{ kg} < 2\text{ kg}$.

b. Steve's total meat purchase was 1.671 kg. Pencil-and-paper methods will vary. A sample answer is given.

$$\begin{array}{r} {\scriptstyle 1} \\ 0.412 \\ +\ 1.259 \\ \hline 1.671 \end{array}$$

c. Checking strategies will vary. Sample answers are given.

$$\begin{array}{r} {\scriptstyle 6\,11} \\ 1.6\cancel{7}\cancel{1} \\ -\ 1.259 \\ \hline 0.412 \end{array} \quad \textbf{or} \quad \begin{array}{r} {\scriptstyle 6\,11} \\ 1.6\cancel{7}\cancel{1} \\ -\ 0.412 \\ \hline 1.259 \end{array}$$

2. Sydney bought a total of 3.847 kg of apples. Mental computation strategies will vary. A sample answer is given.

- Add the whole numbers $(1 + 2 = 3)$.
- Add the tenths $(5 + 3 = 8)$.
- Write the other (trailing) digits to get 3.847 kg.

3. a. Estimation strategies will vary. A sample answer is given.

Round each mass to tenths.

$$\underbrace{0.6 + 0.4} + \underbrace{0.5 + 0.3 + 0.2}$$

$$1\text{ kg} + 1\text{ kg} = 2\text{ kg}$$

b. Ameen bought 1.935 kg of vegetables.

c. Enter the answer to question 3.b. (1.935), and then subtract the five masses one at a time. The display should end up reading 0 (zero).

Keystrokes	ON/C	1.935	–	.567	–	.445	–	.458	–
Display	0	1.935	1.935	0.567	1.368	0.445	0.923	0.458	0.465

.25	–	.215	=
0.25	0.215	0.215	0

Note: This checking procedure can be shortened by one step by using logical reasoning. After you subtract the fourth mass, the display should show the fifth mass.

4. a. Estimation strategies will vary. Sample answers are given.

Method 1: Lee bought about 0.7 kg of sliced ham. Round to tenths. 1.55 kg is about 1.6 kg, and 0.865 kg is about 0.9 kg.

$$1.6 \text{ kg} - 0.9 \text{ kg} = 0.7 \text{ kg}$$

Method 2: Lee bought about 0.5 kg of sliced ham. Round to compatible numbers.

0.868 kg is about 1 kg, and 1.55 kg is about 1.5 kg.

$$1.5 \text{ kg} - 1 \text{ kg} = 0.5 \text{ kg}$$

b. Lee bought 0.685 kg of ham. Methods will vary. A sample answer is given.

$$\begin{array}{r} {\scriptstyle 0\ 14\ 14\ 10} \\ \cancel{1}.\cancel{5}\cancel{5}\cancel{0} \\ -\ 0.8\,6\,5 \\ \hline 0.6\,8\,5 \end{array}$$

c. Checking strategies will vary. A sample answer is given.

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1} \\ 0.6\,8\,5 \\ +\ 0.8\,6\,5 \\ \hline 1.5\,5\,0 \end{array}$$

5. The mass of the piece of cheese was 0.251 kg. Mental-computation strategies will vary. Sample answers are given.

Use adding on.

$3.499 + 0.001 = 3.5$

$3.5 + 0.25 = 3.75$

$0.001 + 0.25 = 0.251$ kg

Use equal addition.

$3.75 + 0.001 = 3.751$

$3.499 + 0.001 = 3.5$

Subtract: $3.751 - 3.5 = 0.251$ kg

6. a. Answers will vary. Sample answers are given.

Using front-end rounding, there are about 0.2 kg of roast beef.

$0.3 \text{ kg} + 0.1 \text{ kg} = 0.4 \text{ kg}$, and $0.6 \text{ kg} - 0.4 \text{ kg} = 0.2 \text{ kg}$

or

Rounding to the nearest tenth of a kilogram, there are about 0.2 kg of roast beef.

$0.7 \text{ kg} - 0.3 \text{ kg} = 0.4 \text{ kg}$, and $0.4 \text{ kg} - 0.2 \text{ kg} = 0.2 \text{ kg}$

b. Using a calculator, there are 0.119 kg of roast beef.

Keystrokes	ON/C	.335	+	.196	=	M+	.65	−	MRC	=
Display	0	0.335	0.335	0.196	0.531	0.531	0.65	0.65	0.531	0.119

or

Keystrokes	ON/C	.65	−	.335	−	.196	=
Display	0	0.65	0.65	0.335	0.315	0.196	0.119

c.

Keystrokes	ON/C	.119	+	.335	+	.196	=
Display	0	0.119	0.119	0.335	0.454	0.196	0.65

7. Answers will vary. Sample answers are given.

a. Brad bought 0.881 kg of deli meat. Use estimation and a calculator.

- First, estimate by rounding each mass to the neartest tenth of a kilogram.

$$0.2\text{ kg} + 0.3\text{ kg} + 0.3\text{ kg} = 0.8\text{ kg}$$

- Next, use a calculator.

$$0.225 + 0.347 + 0.309 = 0.881\text{ kg}$$

- Then compare the two results. The estimate was a little low, so the calculator display is reasonable and you can trust the answer.

b. There were 1.228 kg of oranges in the second bag. Mental computation is the most appropriate method to subtract $2.528 - 1.3$.

- First, subtract the whole numbers.

$$2 - 1 = 1$$

- Next, subtract the tenths.

$$5 - 3 = 2$$

- Then, add on the trailing digits to get 1.228 kg.

c. Raman bought 0.905 kg of candy. Use a pencil-and-paper method because the question isn't that tough.

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ \ \ } \\ 0.356 \\ +\ 0.549 \\ \hline 0.905 \end{array}$$

8. You may find it easier to subtract mentally when there isn't much regrouping needed. You may find it easeir to add mentally when the numbers are compatible.

Activity 3

1. Answers will vary. Sample answers are given.

a. • First, estimate the total expenses (about $85).

Gift wrap: $6 \times \$2.50 = (6 \times \$2) + (6 \times \$0.50)$

$= \$12 + \$3$

$= \$15$

Shipping and handling: about $20

Air delivery: $6 \times \$8 = \$48$ (about $50)

The total expenses are about $\$15 + \$20 + \$50 = \$85$.

• Next, subtract the total expenses from $250 to see how much you can spend.

You can spend about $\$250 - \$85 = \$165$.

• Then, divide the amount you can spend by 6 to give you an idea of about how much you can spend on each item. That way, if you picked an item over that price, you know you would have to pick another item under that price.

$6 \times \$20 = \$120$, and $6 \times \$30 = \$180$, so you would estimate about $25 per item.

• Finally, pick six items and round prices up so you know you can afford them.

1 phone	$40 =	40
2 shower radios	$2 \times \$25 =	50
2 kites	$2 \times \$20 =	40
1 child's robe	$30 =	30
	Total =	$160

• The total cost of these items comes very close to how much you think you can spend.

b. The items are shown on the following completed order form.

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount
LL803	1		Touch Tone Phone	$37.95	$37.95
SR599	2		Shower Radio	$22.95	$45.90
KK139	2		Kite	$18.95	$37.90
RC115	1	M	Child's Robe	$29.95	$29.95

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	$151.70
Gift Wrap ($2.50 per item)	$15.00
Shipping and Handling (see chart)	$13.75
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	$48.00
Total Cost of Order	$228.45

c. There is $21.55 left. Use counting on to subtract.

$$\$228.45 + \mathbf{\$0.55} = \$229;\ \$229 + \mathbf{\$1} = \$230;\ \$230 + \mathbf{\$20} = \$250$$

The amount left over is: $\$0.55 + \$1 + \$20 = \$21.55$.

2. a. First, estimate how much you could afford by subtracting your estimated expenses from $80. Then, to get the greatest number of items, you would start choosing the least expensive items.

- Expenses (about $35):

  Shipping and handling: about $10
  Air delivery: $3 \times \$8 = \$24$ (about $25)
  The total expenses are about $\$10 + \$25 = \$35$.

- Subtract the total expenses from $80 to see how much you can spend.

  You can spend about $\$80 - \$35 = \$45$.

- You would pick the following items:

  Jigsaw Puzzle $14.95
  Thermometer $14.95
  Rice Bowls $15.95

  Merchandise total is about $3 \times \$15 = \$45$

b.

CATALOGUE ORDER FORM

Name _____

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount
JP911	1		Jigsaw Puzzle	$14.95	$14.95
OT886	1		Thermometer	$14.95	$14.95
CM476	1		Rice Bowls	$15.95	$15.95

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	$45.85
Gift Wrap ($2.50 per item)	
Shipping and Handling (see chart)	$6.75
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	$24.00
Total Cost of Order	$76.60

An alternate solution is to buy the following items:

Jigsaw Puzzle	14.95
Thermometer	14.95
Kite	18.95
Merchandise Total	48.85
Shipping and Handling	6.75
Speedy Air Delivery	24.00
Total Cost of Order	$79.60

c. The most expensive item you could buy is the women's robe.

Robe	59.95
Shipping and Handling	8.75
Speedy Air Delivery	8.00
Total Cost	$76.70

However, you would not buy this for yourself; therefore, the next most expensive item you could buy is the pair of running shoes.

Running Shoes	57.95
Shipping and Handling	8.75
Speedy Air Delivery	8.00
Total Cost	$74.70

3. a. You would estimate the sum of the least expensive items, adding one more item at a time to your list until you get near $130. (Take off $20 from $150 to allow for shipping and handling and two gift wraps.)

Puzzle	15
Thermometer	15
Rice Bowls	15
Jeans	20
Kite	20
Sweatshirt	20
Radio	25
Total Estimate	$130

Based on the estimate, Dwayne can buy the seven least expensive items.

b. The total cost of the order is shown at the bottom of the following order form.

CATALOGUE ORDER FORM

Name Dwayne

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount
JP911	1		Jigsaw Puzzle	$14.95	$14.95
OT886	1		Thermometer	$14.95	$14.95
CM476	1		Rice Bowls	$15.95	$15.95
KK139	1		Kite	$18.95	$18.95
WB713	1		Jeans	$19.95	$19.95
SD548	1		Sweatshirt	$20.95	$20.95
SR599	1		Shower Radio	$22.95	$22.95

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	$128.65
Gift Wrap ($2.50 per item)	$5.00
Shipping and Handling (see chart)	$13.75
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	
Total Cost of Order	$147.40

c. Dwayne would have $2.60 left. Use counting on to subtract.

$\$147.40 + \mathbf{\$0.60} = \$148;\ \$148 + \mathbf{\$2} = \$150$

The amount left over is $\$0.60 + \$2 = \$2.60$.

4. a. Massa must pay $120.10 if he decides to have the presents gift wrapped and uses Speedy Air Delivery.

CATALOGUE ORDER FORM

Name Massa

Address _____

Item Number	Quantity	Size	Description	Unit Cost	Amount
LL803	1		Touch Tone Phone	$37.95	$37.95
JP911	1		Jigsaw Puzzle	$14.95	$14.95
CT501	1	50	CD Tower	$24.95	$24.95

Merchandise Total	Shipping and Handling
$0.01–$25.00	$4.75
$25.01–$50.00	$6.75
$50.01–$75.00	$8.75
$75.01–$100.00	$10.75
$100.01–$200.00	$13.75
$200.01–$300.00	$16.75
$300.01–$500.00	$20.75
$500.01–$700.00	$24.75

Merchandise Total	$77.85
Gift Wrap ($2.50 per item)	$7.50
Shipping and Handling (see chart)	$10.75
Speedy Air Delivery (2-day delivery, $8.00 additional per item)	$24.00
Total Cost of Order	$120.10

b. Massa could save $31.50 by not having the presents gift wrapped and not using Speedy Air Delivery $(\$7.50 + \$24.00 = \$31.50)$.

5. a. The greatest total you could spend when ordering four different catalogue items is $370.55, by ordering the four most expensive items (all gift wrapped and sent by Speedy Air Delivery).

Microwave Oven	119.95
Men's Robe	69.95
Women's Robe	59.95
Running Shoes	57.95
Merchandise Total	307.80
Shipping and Handling	20.75
Speedy Air Delivery	32.00
Gift Wrap	10.00
Total Cost of Order	$370.55

b. The least total you could spend when ordering four different catalogue items is $73.55, by ordering the four least expensive items (none gift wrapped and not sent by Speedy Air Delivery).

Jigsaw Puzzle	14.95
Thermometer	14.95
Rice Bowls	15.95
Kite	18.95
Merchandise Total	64.80
Shipping and Handling	8.75
Total Cost of Order	$73.55

6. You would buy the shower radio from the store. Ordering through the catalogue would be more expensive after adding on shipping and handling alone, and you would have to wait for it to be delivered. The shower radio from the catalogue would cost $22.95 plus $4.75 for shipping and handling, for a total of $27.70.

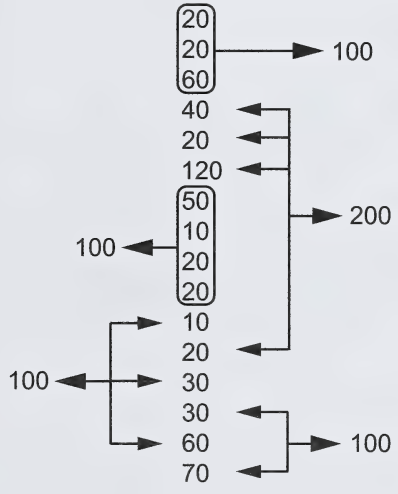
7. Novlett has enough money to buy the three items, provided she doesn't have any of them gift wrapped and if they are not sent by Speedy Air Delivery.

Child's Robe	29.95
Running Shoes	57.95
Shower Radio	22.95
Merchandise Total	110.85
Shipping and Handling	13.75
Total Cost of Order	$124.06

8. a. • Estimate by going from picture to picture, starting at the top left of page 72 and ending at the bottom right of page 73, making sure you don't miss any items.

• Round the prices to the nearest $10, and write them in a long column.

• Combine compatible numbers, circling numbers as you include them. Make a shorter column and find its sum.



100
100
200
100
+ 100
600

• The merchandise total is about $600.

b. The merchandise total is $613.20.

Challenge Activity

Dave had $13.80, Sandra had $15.70, Tom had $1.45, Ken had $10.15, and Linda had $18.90. Solution strategies will vary. Two sample strategies are given.

Method 1

Name	Money Received	Money Paid Out	Difference
Dave	12.00 + 3.05 $15.05	$1.25	15.05 − 1.25 $13.80
Sandra	12.00 2.75 2.80 + 1.25 $18.80	$3.10	18.80 − 3.10 $15.70
Tom	12.00 + 1.95 $13.95	1.50 5.15 2.80 + 3.05 $12.50	13.95 − 12.50 $1.45
Ken	12.00 1.35 + 1.50 $14.85	2.75 + 1.95 $4.70	14.85 − 4.70 $10.15
Linda	12.00 + 5.15 3.10 $20.25	$1.35	20.25 − 1.35 $18.90

Method 2

Dave	Sandra	Tom	Ken	Linda
12.00	12.00	12.00	12.00	12.00
− 1.25	+ 1.25	− 1.50	+ 1.50	+ 3.10
+ 3.05	+ 2.75	− 5.15	− 2.75	+ 5.15
$13.80	− 3.10	− 2.80	+ 1.35	− 1.35
	+ 2.80	+ 1.95	− 1.95	$18.90
	$15.70	− 3.05	$10.15	
		$1.45		

Lesson 3: Multiplying and Dividing Decimals

Activity 1

1. a. The total weight, in newtons, of the three gerbils on the moon can be calculated as follows.

Addition: **Multiplication:**

$0.166\text{N} + 0.166\text{N} + 0.166\text{N}$ $3 \times 0.166\ \text{N}$

b. Use the large cube to represent 1 N. Each flat represents 0.1 N, each rod represents 0.01 N, and each small cube represents 0.001 N.

c.

0.166 N = 1 flat + 6 rods + 6 small cubes

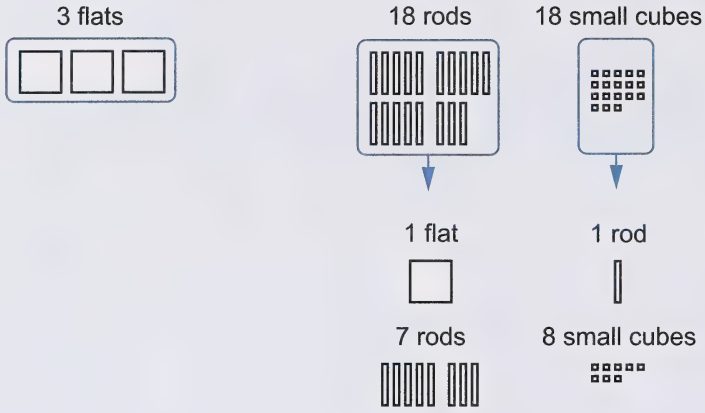
0.166 N = 1 flat + 6 rods + 6 small cubes

0.166 N = 1 flat + 6 rods + 6 small cubes

d. Answers will vary. Sample answers are given.

Method 1

Put all the flats together, all the rods together, and all the units together; then regroup each set.

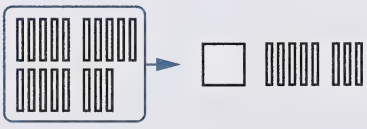


Put all the flats together and all the rods together. You have 4 flats, 9 rods, and 8 small cubes.

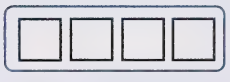
Method 2

Put all 18 small cubes together and regroup them to get 1 rod and 8 small cubes.

Put all 19 rods together and regroup them to get 1 flat and 9 rods.



Put all 4 flats together.



These are the regrouped blocks: 4 flats, 9 rods, and 8 small cubes.

e. The regrouped blocks represent 0.498 N.

2. a. The rat's total weight, in newtons, on Neptune is 5×1.125 N. The rat's total weight, in newtons, on Neptune is $1.125 \text{ N} + 1.125 \text{ N} + 1.125 \text{ N} + 1.125 \text{ N} + 1.125 \text{ N}$.

b. You would add four more sets of counters like the set that is already on the place-value chart. Altogether you would put four more counters in the ones place, four more counters in the tenths place, eight more counters in the hundredths place, and 20 more counters in the thousandths place.

c.

Ones	Tenths	Hundredths	Thousandths
●	●	●●	●●●●●
●	●	●●	●●●●●
●	●	●●	●●●●●
●	●	●●	●●●●●
●	●	●●	●●●●●

d.

Ones	Tenths	Hundredths	Thousandths
●●●●●	●●●●●	●●	●●●●●

e. The rat's weight is 5.625 N on Neptune.

3. Answers will vary. A sample answer is given.

   The hamster's weight will be about 10 N when it lands on Jupiter.

   $2 \times 4\ \text{N} = 8\ \text{N}$ and $3 \times 4\ \text{N} = 12\ \text{N}$

   Since 2.364 is between 2 and 3, the hamster's weight is between 8 N and 12 N.

4. **a.** All the ones were grouped together to make 8 ones. All the tenths were grouped together to make 12 tenths. All the hundredths were grouped together to make 24 hundredths. All the thousandths were grouped together to make 16 thousandths.

   b. The 12 tenths were regrouped to make 1 one and 2 tenths. This made a total of 9 ones.

   c. The 24 hundredths were regrouped to make 2 tenths and 4 hundredths. This made a total of 4 tenths.

   d. The 16 thousandths were regrouped to make 1 hundredth and 6 thousandths. This made a total of 5 hundredths.

   e. The regrouped chips represent 9.456 N, the hamster's weight on Jupiter.

5. **a.** The 4 groups of 2 ones made 8 ones. The 4 groups of 3 tenths made 12 tenths. The 4 groups of 6 hundredths made 24 hundredths. The 4 groups of 4 thousandths made 16 thousandths.

   b. The thousandths were regrouped to make 1 hundredth and 6 thousandths.

   c. The hundredths were regrouped to make 2 tenths and 5 hundredths.

   d. The tenths were regrouped to make 1 one and 4 tenths.

   e. The regrouped chips represent 9.456 N, the hamster's weight on Jupiter.

f.

$$\begin{array}{r} 2.364 \\ \times \quad 4 \\ \hline 0.016 \\ 0.24 \\ 1.2 \\ +\ 8. \\ \hline 9.456 \end{array}$$

or

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 2.364 \\ \times \quad 4 \\ \hline 9.456 \end{array}$$

6. Answers will vary. A sample answer is given.

The mouse would weigh about 4 N on Neptune. 1.125 is a little more than 1, so 3×1.125 would be greater than 3 but less than 4.

7. a. Answers will vary. A sample answer is given.

Ones	Tenths	Hundredths	Thousandths
● ● ●	● ● ●	●● ●● ●●	●●●●● ●●●●● ●●●●●
●●●	●●●	●●●●● ●	●●●●● ●●●●● ●●●●●
●●●	●●●	●●●●● ●●	●●●●●

Ones	Tenths	Hundredths	Thousandths
1 × 3	1 × 3	2 × 3	5 × 3
3	3	6	15
3	3	7	5

b.

$$\begin{array}{r} 1.125 \\ \times \quad 3 \\ \hline 0.015 \\ 0.06 \\ 0.3 \\ +\ 3. \\ \hline 3.375 \end{array}$$

or

$$\begin{array}{r} {\scriptstyle 1} \\ 1.125 \\ \times \quad 3 \\ \hline 3.375 \end{array}$$

c. The mouse would weigh 3.375 N on Neptune.

8. a. Answers will vary. A sample answer is given.

Doris's estimates are reasonable. 0.916 is a little less than 1, so 64×0.916 will be less than 64. 1.125 is a little more than 1, so 64×1.125 will be greater than 64.

b. Doris entered 64 as a constant multiplier and multiplied by 916. (**Note:** On some calculators, you must press the [×] key twice in a row to use the previous number as a constant multiplier.) When Doris got the answer, she only had to enter 1125 and press the [=] key to get the next answer.

c. Doris estimated the rabbit's weight on Saturn to be 60 N, so 58.624 is reasonable. (5.8624 would be much too small, and 586.24 would be much too large.) Doris estimated the rabbit's weight on Neptune to be 70 N, so 72.000 is reasonable. (7.2 would be much too small, and 720.00 would be much too large.)

d.

Keystrokes	ON/C	64	×	.916	=	1.125	=
Display	0	64	64	0.916	58.624	1.125	72

9. Answers will vary. Sample answers are given.

a. The puppy would weigh about 30 N on Mars. (0.377 is less than one-half, and 30 is less than half of 71.)

The puppy would weigh about 150 N on Jupiter. (2.364 is greater than 2, and 150 is greater than twice 71.)

b.

Keystrokes	ON/C	71	×	377	=	2364	=
Display	0	71	71	377	26767	2364	167844

Since the dog would weigh about 30 N on Mars, place the decimal point to make the answer 26.767. Since the dog would weigh about 150 N on Jupiter, place the decimal point to make the answer 167.844.

c.

Keystrokes	ON/C	71	×	.377	=	2.364	=
Display	0	71	71	0.377	26.767	2.364	167.844

10. Answers will vary. Sample answers are given.

a. On Uranus, the monkey would weigh about 70 N, the cat would weigh about 50 N, and the rat would weigh about 8 N. 0.889 is a little less than 1, so the weight of each animal on Uranus will be a little less than its weight on Earth.

b.

Keystrokes	ON/C	889	×	80	=	80	=	9	=
Display	0	889	889	80	71120	80	51562	9	8.001

Since the monkey would weigh about 70 N, place the decimal point to make the answer 71.120 N. Since the cat would weigh about 50 N, place the decimal point to make the answer 51.562 N. Since the rat would weigh about 8 N, place the decimal point to make the answer 8.001 N.

c.

Keystrokes	ON/C	.889	×	80	=	58	=	9	=
Display	0	0.889	0.889	80	71.12	58	51.562	9	8.001

11. Multiplying decimals is the same as multiplying whole numbers in that you can use the same method, and the answers will have the same digits in the same order. Multiplying decimals is different than multiplying whole numbers in that you must decide where to put the decimal point in the answer.

12. a.
$$\begin{array}{r} {\scriptstyle 1} \\ 6.236 \\ \times \quad 2 \\ \hline 12.472 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 1\ 2\ 1} \\ 8.386 \\ \times \quad 3 \\ \hline 25.158 \end{array}$$

c.

$$\begin{array}{r} {\scriptstyle 3\ 7\ 6} \\ 2.498 \\ \times \quad\ 8 \\ \hline 19.984 \end{array}$$

Activity 2

1. a. A little less than 0.2 kg of pure gold was used for each bracelet. 0.885 kg is a little less than $1\ \text{kg} = 1000\ \text{g}$, and $1000\ \text{g} \div 5 = 200\ \text{g} = 0.2\ \text{kg}$.

b. Each flat represents 0.1 kg, each rod represents 0.01 kg, and each small cube represents 0.001 kg.

2. a. Sol put 1 flat in each set, and then he had 3 flats, 8 rods, and 5 small cubes left.

b. Sol regrouped the 3 flats to make 30 rods. That made a total of 38 rods.

c. Sol added 7 rods to each set. That used 35 rods and then he had 3 rods and 5 small cubes left.

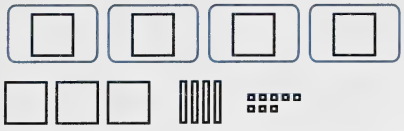
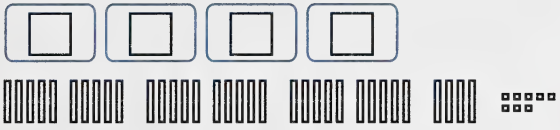
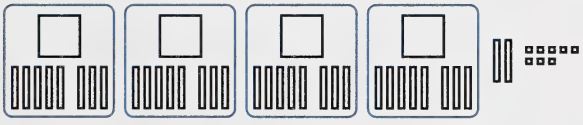
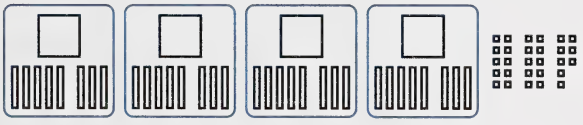
d. Sol regrouped the 3 rods to make 30 small cubes. That made a total of 35 small cubes.

e. Sol added 7 small cubes to each set. That used all 35 small cubes. Each set had 1 flat, 7 rods, and 7 small cubes. This represented 0.177 kg.

f. Each bracelet used 0.177 kg of pure gold.

3. a. A little less than 0.2 kg of pure gold could be extracted from each small bar. 0.748 kg is a little less than 800 g, and $800\ \text{g} \div 4 = 200\ \text{g} = 0.2\ \text{kg}$.

b.

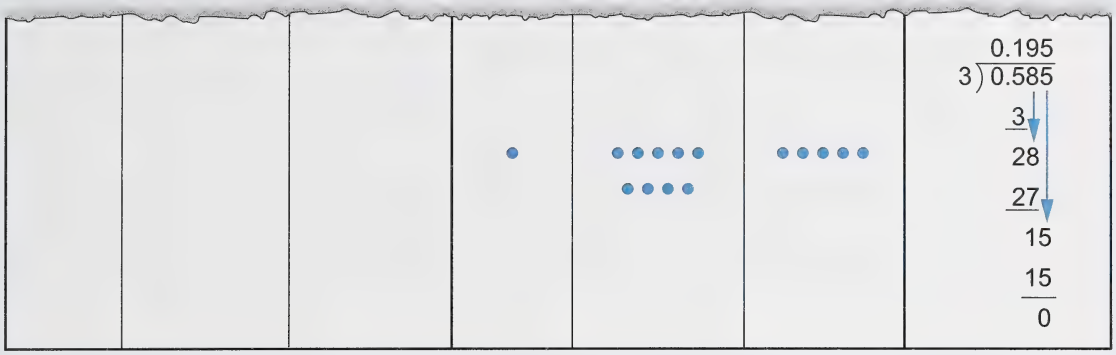
	c. Pencil-and-Paper Method
	$4\overline{)0.748}$
	$\begin{array}{r} 0.1 \\ 4\overline{)0.748} \\ \underline{4} \\ 3 \end{array}$
	$\begin{array}{r} 0.1 \\ 4\overline{)0.748} \\ \underline{4}\downarrow \\ 34 \end{array}$
	$\begin{array}{r} 0.18 \\ 4\overline{)0.748} \\ \underline{4}\downarrow \\ 34 \\ \underline{32} \\ 2 \end{array}$
	$\begin{array}{r} 0.18 \\ 4\overline{)0.748} \\ \underline{4}\downarrow \\ 34 \\ \underline{32}\downarrow \\ 28 \end{array}$
	$\begin{array}{r} 0.187 \\ 4\overline{)0.748} \\ 4\downarrow \\ 34 \\ \underline{32}\downarrow \\ 28 \\ \underline{28} \\ 0 \end{array}$

d. There would be 0.187 kg of pure gold in each of the four smaller bars.

4. **a.** One pack of gold leaf would be a little less than 0.2 mm thick. 0.585 mm is a little less than 0.6 mm, and $0.6 \div 3 = 0.2$.

b.

Picture Showing the Counters Left to Divide			Picture Showing the Counters Put in Each of the Three Sets			Pencil-and-Paper Work
Tenths	Hundredths	Thousandths	Tenths	Hundredths	Thousandths	
●●●●●	●●●●● ●●●	●●●●●				$3\overline{)0.585}$
●●	●●●●● ●●●	●●●●●	●			$\begin{array}{r} 0.1 \\ 3\overline{)0.585} \\ \underline{3} \\ 2 \end{array}$
	●●●●● ●●●●● ●●●●● ●●●●● ●●●●● ●●●	●●●●●	●			$\begin{array}{r} 0.1 \\ 3\overline{)0.585} \\ \underline{3}\downarrow \\ 28 \end{array}$
	●	●●●●●	●	●●●●● ●●●●		$\begin{array}{r} 0.19 \\ 3\overline{)0.585} \\ \underline{3}\downarrow \\ 28 \\ \underline{27} \\ 1 \end{array}$
		●●●●● ●●●●● ●●●●●	●	●●●●● ●●●●		$\begin{array}{r} 0.19 \\ 3\overline{)0.585} \\ \underline{3}\downarrow \\ 28 \\ \underline{27}\downarrow \\ 15 \end{array}$



c. The total thickness of the gold leaves in one package was 0.195 mm.

5. a. The total thickness of the gold leaves in one package was 195 micrometres. If 1 micrometre = 0.001 of a millimetre, then 1 mm = 1000 micrometres, and $0.195 \text{ mm} \times 1000 = 195$ micrometres.

b. The total thickness of the gold leaves in one book was about 10 micrometres. 195 micrometres is almost 200 micrometres and $200 \div 20 = 10$.

c. The total thickness of the gold leaves in each book was $195 \div 20 = 9.75$ micrometres.

6. a. Each gold leaf was about 0.4 micrometre thick. 9.75 micrometres is about 10 micrometres. If there were 20 gold leaves in a book, each one would be 0.5 micrometres thick, but there are 25 gold leaves, so each one will be less than 0.5.

b. Each gold leaf was $9.75 \text{ micrometres} \div 25 = 0.39$ of a micrometre thick.

c. Answers will vary. A sample answer is given.

You would need 2000 to 3000 gold leaves to make a stack that is 1 mm thick.

- Each package contained 20 books, and each book contained 25 gold leaves, so $1 \text{ package} = 20 \times 25 \text{ gold leaves} = 2500$ gold leaves.
- In question 5.c., you found the total thickness of the gold leaves in one package to be 0.195 mm, which is about 0.2 mm.

- Five packages would be 5×0.2 mm thick = 1 mm thick, and 5×500 gold leaves $= 2500$ gold leaves.

7. a. Answers will vary. A sample answer is given.

About 3 km of fine wire can be made from 1 g of gold.

Round 9.828 km down to 9 km, and $9 \text{ km} \div 3 = 3 \text{ km}$.

b.

$$
\begin{array}{r}
3.276 \\
3\overline{)9.828} \\
\underline{9} \\
08 \\
\underline{6} \\
22 \\
\underline{21} \\
18 \\
\underline{18} \\
0
\end{array}
$$

3.276 km of fine wire can be made from 1 g of gold.

c. 32.76 km of fine wire can be made from 10 g of gold. It can make wire 10 times as long because 10 times more gold is used.

8. a. Answers will vary. A sample answer is given.

The mass of a bracelet made from 1 cm^3 of this aluminum alloy would be almost 3 g.

Round 19.319 g to 21 g because $21 \div 7 = 3$.

b.

$$
\begin{array}{r}
2.759 \\
7\overline{)19.319} \\
14 \\
\hline
53 \\
49 \\
\hline
41 \\
35 \\
\hline
69 \\
63 \\
\hline
6
\end{array}
$$

c. The mass of the bracelet would be about 2.76 g.

9. a. Answers will vary. A sample answer is given.

The mass of one coin was about 30 g. 93.311 g is about 90 g and $90\ \text{g} \div 3 = 30\ \text{g}$.

b.

$$
\begin{array}{r}
31.1036 \\
7\overline{)93.3110} \\
9 \\
\hline
03 \\
3 \\
\hline
03 \\
3 \\
\hline
011 \\
9 \\
\hline
20 \\
18 \\
\hline
2
\end{array}
$$

c. The mass of one coin is about 31.104 g.

10. a.
$$\begin{array}{r} 1.263 \\ 2\overline{)2.526} \\ \underline{2\downarrow} \\ 05\downarrow\downarrow \\ \underline{4\downarrow} \\ 12\downarrow \\ \underline{12\downarrow} \\ 06\downarrow \\ \underline{6} \\ 0 \end{array}$$

b.
$$\begin{array}{r} 2.364 \\ 3\overline{)7.092} \\ \underline{6\downarrow} \\ 10\downarrow\downarrow \\ \underline{9\downarrow} \\ 19\downarrow \\ \underline{18\downarrow} \\ 12\downarrow \\ \underline{12} \\ 0 \end{array}$$

c.
$$\begin{array}{r} 1.394 \\ 5\overline{)6.970} \\ \underline{5\downarrow} \\ 19\downarrow\downarrow \\ \underline{15\downarrow} \\ 47\downarrow \\ \underline{45\downarrow} \\ 20\downarrow \\ \underline{20} \\ 0 \end{array}$$

d.
$$\begin{array}{r} 3.62 \\ 21\overline{)76.02} \\ \underline{63\downarrow} \\ 130\downarrow\downarrow \\ \underline{126\downarrow} \\ 42\downarrow \\ \underline{42} \\ 0 \end{array}$$

e.
$$\begin{array}{r} 3.6 \\ 52\overline{)187.2} \\ \underline{156\downarrow} \\ 312\downarrow \\ \underline{312} \\ 0 \end{array}$$

f.
$$\begin{array}{r} 0.36 \\ 13\overline{)4.68} \\ \underline{39\downarrow} \\ 78\downarrow \\ \underline{78} \\ 0 \end{array}$$

Activity 3

1. Answers will vary. Sample answers are given.

Item	Work Done to Decide Best Buy	Best Buy	
		Food Mart	Grocery Land
2% Milk	Food Mart: 4 L cost $2.99 Grocery Land: 1 L costs $1.39 4 L cost $4 \times \$1.39 > \$4.00$	✓	

Orange Juice	Food Mart: 2 L cost $3.99 Grocery Land: 1 L costs $2.19 2 L cost $2 \times \$2.19 > \$4.00$	✓	
Tuna Fish	Food Mart: 400 g cost $3.89 $400\ g \div 2 = 200\ g$ and $\$3.89 \div 2 < \$2.00$ 200 g cost less than $2.00 Grocery Land: 184 g cost $2.19 2 L cost $2 \times \$2.19 > \$4.00$	✓	
String Cheese	Food Mart: 1 kg costs $7.59 Grocery Land: 224 g costs $1.99 $4 \times 224\ kg < 1\ kg$ and $4 \times \$1.99$ is almost $8 1 kg costs more than $8.00	✓	
Kidney Beans	Food Mart: 796 mL cost $1.89 (800 mL cost about $1.90) Grocery Land: 398 mL costs $0.69 (400 mL cost about $0.70) $2 \times 400\ mL = 800\ mL$ and $2 \times \$0.70$ is $1.40 800 L cost about $1.40		✓
Pita Bread	Food Mart: 24-pack costs $1.99 Grocery Land: 12-pack costs $1.99 $(2 \times 12 = 24)$	✓	
Crispy Cereal	Food Mart: 625 g cost $2.79 Grocery Land: 375 g cost $3.89 (about 100 g for $1) At 100 g for $1, 625 g would cost $> \$6$	✓	
Grape Jelly	Food Mart: 500 mL cost $2.79 Grocery Land: 218 mL costs $2.19 (about 100 mL for $1) At 100 mL for $1, 500 mL would cost $5	✓	
Rice	Food Mart: 10 kg cost $10.49 Grocery Land: 2 kg costs $2.99 (about $3) 10 kg cost about $5 \times \$3 = \$15$	✓	

Pierogis	Food Mart: 350 g cost $1.29 Grocery Land: 500 g cost $1.49 (about $1.50) 100 g cost about $1.50 ÷ 5 = $0.30 400 g would cost 4 × $0.30 = $1.20		✓
Salmon	Food Mart: 2 kg cost $22.50 Grocery Land: 1 kg costs $15.40 2 kg cost 2 × $15.40 > $30	✓	
Laundry Detergent	Food Mart: 12 L cost $7.99 (about $8) 24 L cost about 2 × $8 = $16 Grocery Land: 8 L costs $5.99 (about $6) 24 L cost about 3 × $6 = $18	✓	
Apples	Food Mart: 2.27 kg cost $3.99 Grocery Land: 1 kg costs $2.84 2 kg cost 2 × $2.84 > $4	✓	
Peanut Butter	Food Mart: 500 g cost $3.19 2 kg would cost 4 × $3.19 > $12 Grocery Land: 2 kg costs $8.59		✓
Toothpaste	Food Mart: 100 mL cost $1.29 Grocery Land: 75 mL cost $0.99 25 mL would cost $0.99 ÷ 3 = $0.33 100 mL would cost $0.33 × 4 = $1.32	✓	
Burritos	Food Mart: 336 g cost $1.29 Grocery Land: 2 kg cost $2.39		✓
Dog Food	Food Mart: 2 kg cost $4.59 Grocery Land: 8 kg would cost $15.79		✓

Ketchup	Food Mart: 1 L costs \$1.59 (about \$1.60) Grocery Land: 375 mL cost \$1.29	✓	
Ice Cream	Food Mart: 1 L costs \$3.29 2 L would cost $2 \times \$3.29 > \$6$ Grocery Land: 2 L cost \$4.99		✓
Pretzels	Food Mart: 1.36 kg cost \$3.99 Grocery Land: 280 g cost \$1.99 (about \$2) $3 \times 280\ g < 1\ kg$ and $3 \times \$2 = \$6$ 1 kg costs more than \$6	✓	

2. Answers will vary. A sample answer is given.

You might shop at Food Mart because 14 of the 20 items in question 1 were a better buy at that store, compared to Grocery Land, which was the best buy for only 6 items.

Challenge Activity

Eight people, including the twins, went to lunch. Solution strategies will vary. Two sample strategies are given.

Number of People	Number of Cousins	Amount Each Cousin Paid	Cost of Each Person's Meal	Cost of Each Meal × Number of People
4	2	$\$78.00 \div 2 = \$39.00$	$\$39.00 - \$3.25 = \$35.75$	$\$35.75 \times 4 = \$143.00$
5	3	$\$78.00 \div 3 = \$26.00$	$\$26.00 - \$3.25 = \$22.75$	$\$22.75 \times 5 = \$113.75$
6	4	$\$78.00 \div 4 = \$19.50$	$\$19.50 - \$3.25 = \$16.25$	$\$16.25 \times 6 = \$97.50$
7	5	$\$78.00 \div 5 = \$15.60$	$\$15.60 - \$3.25 = \$12.35$	$\$12.35 \times 7 = \$86.45$
8	6	$\$78.00 \div 6 = \$13.00$	$\$13.00 - \$3.25 = \$9.75$	$\$9.75 \times 8 = \$78.00$

Number of People	Number of Cousins	Cost of One Meal	Extra Amount Each Cousin Pays for Twins' Meals
4	2	$\$78.00 \div 4 = \$19.50$	$\frac{(19.50 \times 2)}{2} = \$19.50$ (too much)
5	3	$\$78.00 \div 5 = \$15.60$	$\frac{(15.60 \times 2)}{3} = \$10.40$ (too much)
6	4	$\$78.00 \div 6 = \$13.00$	$\frac{(13.00 \times 2)}{4} = \$6.50$ (too much)
7	5	$\$78.00 \div 7 = \$11.14$	$\frac{(11.14 \times 2)}{5} = \$4.46$ (too much)
8	6	$\$78.00 \div 8 = \$9.75$	$\frac{(9.75 \times 2)}{6} = \$3.25$ (yes!)

Keystrokes

1. For the first part of a split number, use a 6 for any digit that is 7, 8, or 9. Use the exact digit for any digit that is 6 or less.

   For the second part of a split number, use digits that add with the first part to make the original number.

2. 19 678 + 75 819

		19678				75819			
Keystrokes	ON/C	16666	+	3012	+	65616	+	10203	=
Display	0	16666	16666	3012	19678	65616	85294	10203	95497

3. 67 384 – 48 993

		67384				48993			
Keystrokes	ON/C	66364	+	1020	–	46663	–	2330	=
Display	0	66364	66364	1020	67384	46663	20721	2330	18391

4. $97 \times 75\ 387$

		97				75387					
Keystrokes	ON/C	66	+	31	M+	65366	+	10021	×	MRC	=
Display	0	66	66	31	97	65366	65366	10021	75387	97	7312539

5. $80\ 388 \div 87$

		87				80388					
Keystrokes	ON/C	66	+	31	M+	60366	+	20022	×	MRC	=
Display	0	66	66	31	87	60366	60366	20022	80388	87	924

6. $2.6 \times \square = 71$

Keystrokes	ON/C	2.6	×	25	=	27	=	28	=
Display	0	2.6	2.6	25	65	27	70.2	28	72.8

This shows that the missing factor is between 27 and 28 but closer to 27.

Don't clear your calculator.

Keystrokes	27.2	=	27.3	=	27.4	=
Display	27.2	70.72	27.3	70.98	27.4	71.24

This shows that the missing factor is between 27.3 and 27.4 but closer to 27.3.

Don't clear your calculator.

Keystrokes	27.31	=
Display	27.31	71.006

This shows that the missing factor is between 27.3 and 27.31 but closer to 27.31.

Now divide to check the work.

Keystrokes	ON/C	71	÷	2.6	=
Display	0	71	71	2.6	27.30762

7. $4.2 \times \square = 125$

Keystrokes	ON/C	4.2	×	30	=	28	=	29	=
Display	0	4.2	4.2	30	126	28	117.6	29	121.8

This shows that the missing factor is between 29 and 30 but closer to 30. **Don't clear your calculator.**

Keystrokes	29.6	=	29.7	=	29.8	=
Display	29.6	124.32	29.7	124.74	29.8	125.16

This shows that the missing factor is between 29.7 and 29.8 but closer to 29.8. **Don't clear your calculator.**

Keystrokes	29.78	=	29.77	=	29.76	=
Display	29.78	125.076	29.77	125.034	29.76	124.992

This shows that the missing factor is between 29.76 and 29.77 but closer to 29.76. **Don't clear your calculator.**

Keystrokes	29.762	=	29.761	=
Display	29.762	125.0004	29.761	124.9962

This shows that the missing factor is between 29.761 and 29.762 but closer to 29.762.

Now, divide to check the work.

Keystrokes	ON/C	125	÷	4.2	=
Display	0	125	125	2.6	29.761904

Review

1. Answers will vary. Sample answers are given.

a. The population increased by about 1 600 000 between 1960 and 2000.

Using front-end rounding: $2\,800\,000 - 1\,200\,000 = 1\,600\,000$
Using a calculator: $2\,879\,743 - 1\,265\,572 = 1\,614\,171$

b. The population increased by about 300 000 between 1960 and 1970.

Using front-end rounding: $1\,500\,000 - 1\,200\,000 = 300\,000$
Using a calculator: $1\,576\,549 - 1\,265\,572 = 310\,977$

c. The population increased by about 500 000 between 1970 and 1980.

Using front-end rounding: $2\,000\,000 - 1\,500\,000 = 500\,000$
Using a calculator: $2\,094\,212 - 1\,576\,549 = 517\,663$

d. The population increased by about 400 000 between 1980 and 1990.

Using front-end rounding: $2\,400\,000 - 2\,000\,000 = 400\,000$
Using a calculator: $2\,469\,069 - 2\,094\,212 = 374\,857$

e. The population increased by about 400 000 between 1990 and 2000.

Using front-end rounding: $2\,800\,000 - 2\,400\,000 = 400\,000$
Using a calculator: $2\,879\,743 - 2\,469\,069 = 410\,674$

2. Answers will vary. A sample answers is given.

Alberta's population in 2010 will be about 3 200 000. The answers to question 1 show that in each of the ten-year intervals, from 1980 to 1990 and from 1990 to 2000, the population increased by about 400 000. In the ten-year interval from 2000 to 2010, the population is again likely to increase by about 400 000.

Using front-end rounding: $2\,800\,000 + 400\,000 = 3\,200\,000$

3. a. Between 1966 and 1967, there was a decrease in Alberta's population.

b. The population decreased by 1822 people between 1966 and 1967.
Using a calculator: $1\,459\,746 - 1\,457\,924 = 1822$

4. a. Alberta's 1992 population of 2 543 033 was closest to being twice as great as in 1960.

Using a calculator: 1960 population $\times 2 = 1\,265\,572 \times 2$
$= 2\,531\,144$

b. Alberta's 1965 population of 1 425 543 was closest to being half as great as in 2000.

Using a calculator: 2000 population $\div 2 = 2\,879\,743 \div 2$
$= 1\,439\,871.5$

The answer is either 1965 or 1967, so use subtraction to decide.

1965: $1\,439\,871 - 1\,425\,543 = 14\,328$
1967: $1\,457\,924 - 1\,439\,871 = 18\,053$

5. a. Alberta's population was about 40 times greater in 2000 than it was in 1901.

Using compatible numbers, round 2 879 743 to 2 800 000 and 73 000 to 70 000.

$2\,800\,000 \div 70\,000 = 40$ 374 000 is between 350 000 and 420 000.

b. Alberta's population was about 5 or 6 times greater in 1911 than it was in 1901.

Round 73 000 to 70 000.

$5 \times 70\,000 = 350\,000$ and $6 \times 70\,000 = 420\,000$

374 000 is between 350 000 and 420 000.

6. a. In 1921, Alberta's population of 589 000 was about one-fifth of its population in 2000.

Round the 2000 population to 3 000 000.

$$3\,000\,000 \div 5 = 600\,000$$

b. In 1951, Alberta's population of 940 000 was about one-third of its population in 2000.

Round 2000 population to 3 000 000.

$$3\,000\,000 \div 3 = 1\,000\,000$$

7. The longest lake, Lake Superior, is 252 km longer than the shortest lake, Lake Ontario.

$$563 \text{ km} - 311 \text{ km} = 252 \text{ km}$$

8. a. The area of the largest lake, Lake Superior, is 63 140 km^2 greater than the smallest lake, Lake Ontario.

$$82\,100 \text{ km}^2 - 18\,960 \text{ km}^2 = 63\,140 \text{ km}^2$$

b. Lake Superior is about 4 times larger in area than Lake Ontario.

Using compatible numbers, round $82\,100 \text{ km}^2$ to $80\,000 \text{ km}^2$, and round $18\,960 \text{ km}^2$ to 20 000.

$$80\,000 = 4 \times 20\,000$$

9. a. Lake Superior's maximum depth is 342 m more than Lake Erie's maximum depth.

Lake Superior's maximum depth – Lake Erie's maximum depth
$= 406 \text{ m} - 64 \text{ m}$
$= 342 \text{ m}$

b. Lake Superior is about 6 times deeper than Lake Erie.

Using compatible numbers, round 64 km down to 60 km and round 406 km down to 360 km.

$$6 \times 60 = 360$$

10. a. Both Lake Erie and Lake Ontario have about one-half of their area in Canada.

Lake Erie: Using rounding: $26\,000\ \text{km}^2 \div 2 = 13\,000\ \text{km}^2$

Using a calculator: $25\,700\ \text{km}^2 \div 2 = 12\,850\ \text{km}^2$

Lake Ontario: Using rounding: $20\,000\ \text{km}^2 \div 2 = 10\,000\ \text{km}^2$

Using a calculator: $18\,960\ \text{km}^2 \div 2 = 9480\ \text{km}^2$

b. Lake Superior has about one-third of its area in Canada.

Using compatible numbers: $3 \times 25\,000 = 75\,000\ \text{km}^2$ and

$3 \times 30\,000 = 90\,000\ \text{km}^2$

Using a calculator: $82\,100\ \text{km}^2 \div 3 \doteq 27\,366.666\ \text{km}^2$ $\left(\text{about } 27\,367\ \text{km}^2\right)$

11. a. The total area of the five Great Lakes is about $250\,000\ \text{km}^2$.

Using rounding: $80\,000 + 60\,000 + 60\,000 + 30\,000 + 20\,000 = 250\,000\ \text{km}^2$

Using a calculator: $82\,100 + 57\,800 + 59\,600 + 25\,700 + 18\,960 = 244\,160\ \text{km}^2$

b. Most of the total area of the Great Lakes is in the United States. Canadian area is about
$30\,000\ \text{km}^2 + 40\,000\ \text{km}^2 + 10\,000\ \text{km}^2 + 10\,000\ \text{km}^2 = 90\,000\ \text{km}^2$.

This is less than the total area found in question 11.a.

12. Answers will vary. Sample answers are given.

a. The mass of the bags could have been 2 kg and 5.168 kg. Choose any mass for the first bag and add 3.168 kg to it to get the mass of the second bag.

b. The pairs of pants could have cost \$50, \$40, \$30, and \$32.75. Choose three whole dollar amounts that are easy to add mentally $(\$50 + \$40 + \$30 = \$120)$, and then subtract \$120 from \$152.75 to get \$32.75.

13. a. $\$245.32 - \$173.82 = \$71.50$, and $\$245.32 - \$71.50 = \$173.82$

b. $45.813 \text{ L} - 33.657 \text{ L} = 12.156 \text{ L}$, and $33.657 \text{ L} + 12.156 \text{ L} = 45.813 \text{ L}$

14. a. The total cost to buy one of each of the four items is about \$54.

Round \$11.99 to \$12, \$15.69 to \$16, and \$7.99 to \$8.

$$\$12 + \$18 + \$16 + \$8 = \$54$$

b. I began by adding all the number of cents each price was rounded up.

$$\$0.01 + \$0.31 + \$0.01 = \$0.33$$

Then, I subtracted this sum from my estimate.

$$\begin{aligned} \$54.00 - \$0.33 &= (\$54.00 - \$0.30) - \$0.03 \\ &= \$53.70 - \$0.03 \\ &= \$53.67 \end{aligned}$$

c.

Items	Estimate	Amount Rounded Up	Total Cost
Team shirt	\$12.00	\$0.01	$\$46.00 - \$0.32 = (\$46.00 - \$0.30) - \$0.02 = \$45.70 - \$0.02 = \$45.68$
Sweatshirt	\$18.00	\$0.00	
Hiking shorts	\$16.00	\$0.31	
Total	\$46.00	\$0.32	

Items	Estimate	Amount Rounded Up	Total Cost
Team shirt	$12.00	$0.01	$38.00 – $0.02 = $37.98
Sweatshirt	$18.00	$0.00	
Baseball Cap	$8.00	$0.01	
Total	$38.00	$0.02	

Items	Estimate	Amount Rounded Up	Total Cost
Team shirt	$12.00	$0.01	$36.00 – $0.33 = ($36.00 – $0.30) – $0.03 = $35.70 – $0.03 = $35.67
Hiking shorts	$16.00	$0.31	
Baseball Cap	$8.00	$0.01	
Total	$36.00	$0.33	

Items	Estimate	Amount Rounded Up	Total Cost
Sweatshirt	$18.00	$0.00	$42.00 – $0.32 = ($42.00 – $0.30) – $0.02 = $41.70 – $0.02 = $41.68
Hiking shorts	$16.00	$0.31	
Baseball Cap	$8.00	$0.01	
Total	$42.00	$0.32	

15. Textbook, page 76, Practise Your Skills, questions 1 to 6

1. 5191 **2.** 3005 **3.** 19.547
4. 0.796 **5.** 31.258 **6.** 74.073

16. Textbook, page 96, Skill Bank from This Unit, question 6

a. 2759 **b.** 8438 **c.** 659.88
d. 19.142 **e.** $45.69 **f.** 1.891

17. Textbook, page 78, On Your Own, question 3

Answers will vary. Sample answers are given.

Round 75 years or 81 years to 80 years.

- You would expect to eat about 120 kg of peanut butter.

  Round 1.57 kg to 1.5 kg.

$$\begin{aligned} 80 \times 1.5 \text{ kg} &= 80 \times (1 + 0.5) \text{ kg} \\ &= 80 \text{ kg} + 40 \text{ kg} \\ &= 120 \text{ kg} \end{aligned}$$

  Using a calculator: $75 \times 1.57 = 117.75$ kg (male)

  $81 \times 1.57 = 127.17$ kg (female)

- You would expect to eat about 52 kg of salsa.

$$80 \times 0.6 \text{ kg} = 48 \text{ kg}$$
$$80 \times 0.7 \text{ kg} = 56 \text{ kg}$$

  80×0.64 kg is between these.

  Using a calculator: $75 \times 0.64 = 48$ kg (male)

  $81 \times 0.64 \text{ kg} = 51.84$ kg (female)

- You would expect to eat about 360 kg of spaghetti.

$$80 \times 4 \text{ kg} = 320 \text{ kg}$$
$$80 \times 5 \text{ kg} = 400 \text{ kg}$$

  80×4.65 kg is between these.

  Using a calculator: $75 \times 4.65 = 348.75$ kg (male)

  $81 \times 4.65 \text{ kg} = 376.65$ kg (female)

18. Answers will vary. Sample answers are given.

a. Round 7.3 kg down to 7 kg and round 16 buns up to 20 buns.

$7 \text{ kg} \div 2 = 3.5 \text{ kg}$, and 20 buns per kilogram $\times$ $3.5 \text{ kg} = 70$ buns

Each person would eat about 70 hamburger buns per year.

Using a calculator:

Keystrokes	ON/C	7.3	÷	2	=	×	16	=
Display	0	7.3	7.3	2	3.65	3.65	16	58.4

Each person would eat about 58 hamburger buns per year.

b. Round 58 buns up to 60 buns and round 0.11 kg to 0.1 kg.

$60 \text{ buns} \times 0.1 \text{ kg} = 6 \text{ kg}$

Each person would eat about 6 kg of hamburger meat per year.

Using a calculator:

Keystrokes	ON/C	58	×	.11	=
Display	0	58	58	0.11	6.38

Each person would eat about 6.38 kg of hamburger meat per year.

c. $15 \text{ mL} \div 3 = 5 \text{ mL}$

Round 58 buns to 60 buns.

$60 \text{ buns} \times 5 \text{ mL per bun} = 300 \text{ mL} = 0.3 \text{ L}$

Each person would eat about 0.3 L of ketchup on hamburgers per year.

Using a calculator:

Keystrokes	ON/C	5	×	58	=
Display	0	5	5	58	290

Each person would eat about 290 mL = 0.29 L of ketchup on hamburgers per year.

d. Round 58 buns to 60 buns.

$$60 \text{ buns} \times 30 \text{ g} = 1800 \text{ g} = 1.8 \text{ kg}$$

Each person would eat about 1.8 kg of cheese on hamburgers per year.

Using a calculator:

Keystrokes	ON/C	30	×	58	=
Display	0	30	30	58	1740

Each person would eat about 1740 g = 1.74 kg of cheese on hamburgers per year.

19. Textbook, page 81, Practise Your Skills, questions 1 to 8

	Estimate	Calculate
1.	$30 \times 50 = 150$	168.5
2.	$5 \times 50 = 250$	249.6
3.	$0.7 \times 7 = 4.9$	4.9
4.	$50 \times 20 = 1000$	1108.6
5.	$12 \times 10 = 120$	115.74
6.	$70 \times 7 = 490$	504.42
7.	$3 \times 15 = 45$	40.64
8.	$50 \times 20 = 1000$	1016.5

20. Textbook, page 83, Practise Your Skills, questions 1 to 6

	Estimate	Calculate
1.	$\$10 \div 10 = \$1$	\$1.21 (rounded to nearest cent)
2.	$\$20 \div 5 = \$4$	\$3.54 (rounded to nearest cent)
3.	$\$26 \div 10 = \$2.60$	\$2.60 (rounded to nearest cent)
4.	$\$1.80 \div 6 = \$0.30$	\$0.33 (rounded to nearest cent)
5.	$28 \div 4 = 7$	6.825
6.	$0.63 \div 7 = 0.09$	0.093 (rounded to nearest thousandth)

21. Textbook, page 96, Skill Bank from This Unit, question 7

	Estimate	Calculate
a.	$1000 \times 30 = 30\,000$	29 580
b.	$60 \times 9 = 540$	528.3
c.	$300 \times 7 = 2100$	2144
d.	$770 \div 7 = 110$	122.714 (rounded to nearest thousandth)
e.	$60 \div 3 = 20$	19.42
f.	$2.4 \div 4 = 0.6$	0.625

22. Textbook, pages 92 to 94, Problem Bank, questions 4.b., 4.c., 10, 11, 12, and 13

4. b. If you eat in, the first restaurant's price of \$7.50 is a better deal. If you want delivery, the \$8.95 price of the restaurant next door is a better deal. You would pay \$9.50 at the first restaurant $(\$7.50 + \$2$ delivery$)$.

c. If you order salad, then you will have $\$8.50 - \$2.50 = \$6$ for a main course. The only main course you could order is pasta with tomato sauce for \$5.95. If you order soup, then you will have $\$8.50 - \$1.95 = \$6.55$ for a main course. You could order pasta with tomato sauce for \$5.95 or pizza with cheese for \$6.50.

10. a. Answers will vary. Sample answers are given.

I would rather have the second choice. To find out how much I would get, I need to add all the numbers from 1 to 31, depending on the month. Using my calculator, if I press M+ after I enter each number, and the calculator will total the numbers each time.

Keystrokes	ON/C	1	M+	2	M+	3	M+	...	28	M+	MRC
Display	0	1	1	2	2	3	3	...	28	28	406

29	M+	MRC	30	M+	MRC	31	M+	MRC	31	M+	MRC
29	29	435	30	30	465	31	31	465	31	31	496

b. I would make the same choice for any month. Even in February, the shortest month, I would get $406.

11. a. You save $1.13 on each CD if you buy two.

$\$32.50 \div 2 = \$16.25$
$\$17.38 - \$16.25 = \$1.13$

You save $2.05 on each CD if you buy three.

$\$45.98 \div \$15.33$
$\$17.38 - \$15.33 = \$2.05$

b. You save $2.26 in all if you buy two CDs at the special price.

$2 \text{ CDs at regular price} = 2 \times \$17.38$
$= \$34.76$

$\$34.76 - \$32.50 = \$2.26$

You save \$6.16 in all if you buy three CDs at the special price.

$$\begin{aligned} 3 \text{ CDs at regular price} &= 3 \times \$17.38 \\ &= \$52.14 \end{aligned}$$

$$\$52.14 - \$45.98 = \$6.16$$

c. The special price for three CDs is the best buy because you pay the least for one CD.

12. Brand Y is the best buy. Brand X gives you 100 sheets for about \$1.50, which is about 1.5¢ per sheet; 80 sheets at 1.5¢ per sheet would be $80¢ + 40¢ = \$1.20$, but Brand Y gives you 85 sheets for \$1.19, so Brand Y is a better buy than Brand X. Brand Z gives you 90 sheets for about \$1.80, which is about 2¢ per sheet.

13. a. They are earning more money at the Chiu's house. Depending on the year, there will be 17 or 18 Saturdays in the 4 months.

$$\begin{aligned} 17 \text{ Saturdays} \times \$15.00 &= (20 \times \$15.00) - (3 \times \$15.00) \\ &= \$300 - \$45 \\ &= \$225 \end{aligned}$$

18 Saturdays would be \$15 more.

$$\$225 + \$15 = \$270$$

b. If they divide the money equally, each girl would earn \$252.50 if they worked 17 Saturdays; and each girl would earn \$260 if they worked 18 Saturdays.

$\$250 + \$225 = \$505$, and $\$505 \div 2 = \$252.50$
$\$250 + \$270 = \$520$, and $\$520 \div 2 = \$260$

Just the Facts

Multiplication and Division Facts

9	3	10	4	0
5	0	2	20	6
24	7	24	9	72
8	16	5	6	1
16	9	42	0	0

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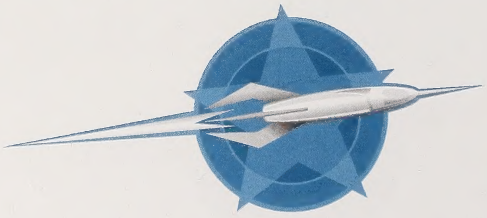

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